

# MOSS FLORA

OF

## NORTH AMERICA

North of Mexico

BY

A. J. GROUT, PH.D.

FELLOW AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE; MEMBER  
BOTANICAL SOCIETY OF AMERICA; FOUNDER AND ASSOCIATE EDITOR OF  
THE BRYOLOGIST; MEMBER ALL YEAR STAFF, BIOLOGICAL  
LABORATORY, COLD SPRING HARBOR, L. I., N. Y.

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## BRYACEAE (Concluded).

By A. LEROY ANDREWS.

## 7. BRYUM L. Sp. Pl. 1115 (in part). 1753.

*Ptychostomum* Hornsch. Flora 5<sup>2</sup>: Syll. 62. 1822.*Hemisynapsium* Brid. Bryol. Univ. 1: 604. 1826.*Cladodium* Brid. Bryol. Univ. 1: 620. 1826.*Argyrobryum* (C. M.) Hpe. Linnaea 40: 312. 1876.

Plants erect, generally tufted; stems short to several cm. in length, usually matted with radicles in lower part, often branching, especially by subfloral innovations, pentagonal in section with central strand and a cortex of thick-walled, generally pigmented cells; leaves usually rather broad, ovate or ovate-lanceolate to oval, acuminate to obtuse or rarely rounded at apex, erect-spreading to imbricate, margin entire or nearly so and frequently with a differentiated border of narrower cells; costa slender to strong, rarely failing to reach apex, in section strongly convex dorsally, ventrally conforming to the plane of the leaf-blade, with single row of guide-cells, ventral cells few and large, generally in a single layer, dorsal cells also tending to be somewhat enlarged in a single layer, stereid band single, dorsal; leaf blade of a single thickness of cells, except that the border is rarely thickened; cells in basal part rectangular, in upper part rhomboidal-hexagonal, mostly broader than in *Pohlia*, their walls sometimes pitted. Inflorescence terminal, dioicous, synoicous or autoicous, paraphyses filiform. Seta strong and elongated, twisted in drying, generally red or reddish; capsule horizontal to mostly pendulous, clavate to pyriform to oval, with neck mostly clearly differentiated; calyptula cucullate, small and fugacious; annulus normally present, large and removable; stomata only in neck of capsule, phaneropore; peristome double, endostome sometimes imperfect or clinging to exostome; teeth of exostome varying greatly in form and surface-markings; endostome also varying in form of segments and presence and character of cilia, the latter often appendiculate; spores varying somewhat in color, size and surface conditions. Type species, *B. argenteum* L.

A large and unwieldy genus of closely related species, which has hitherto successfully defied further dismemberment into genera; even a clear division into subgenera or sections is not indicated and attempts in this direction have not been fully successful; one can at most recognize numerous groups of apparently related forms. For practical reasons, as in the case of *Pohlia*, it is customary to start with the species of more rudimentary inner peristome, but the species with complete peristome are obviously not to be conceived of as necessarily deriving directly from those with less complete peristomes. The first species under the genus *Bryum*, both with Linné (1753) and Hedwig (1801), do not belong to it as at present understood; the first species included by Linné which is still called *Bryum* is *B. argenteum* L., the first by Hedwig is *B. caespiticium* L.

*Bryum* has long been considered, and not entirely without reason, an especially difficult and critical genus. The hundreds of European species which have been and are still being proposed, to say nothing of the numerous ones from other regions, have unfortunately not helped to clarify things, but on the contrary to render them more obscure. As a matter of fact real knowledge of the genus has not progressed greatly beyond the point where it was left by Schimper. The early American bryologists, who leaned heavily upon Schimper, misinterpreted a few species, rather more than in most genera, but it is remarkable that they correlated the American material with the European as well as they did. The increasing exploitation of the Norwegian wealth in *Bryum* forms, with which Schimper had already become acquainted at first hand, misled in the first place Limprecht into a quite unjustified expansion of European *Bryum* species, which once started has been continued by less careful and able bryologists. Lindberg's studies, especially in the arctic species, are of value, but, as in other genera, not all his species can be maintained. In more recent time Hagen, who lived for many years in the heart of the classical *Bryum* region in Norway, has been considered an authority upon the genus, and with good reason. I have been enabled, first through material furnished me by Hagen before his death and later through the kindness of Mr. Ove Arbo Höeg in Trondheim, to study in detail his *Bryum* herbarium and find it on the whole in good condition, with good specimens carefully and fairly consistently named, though by no means justifying the enormous number of species which he recognized and endowed with lengthy descriptions. One finds for example in closely related species represented by a number of specimens that his own specimens may decidedly overlap in their characters as between the two species; occasionally one finds more flagrant errors, for instance a species based upon two specimens obviously not conspecific, or in the worst cases a *Pohlia* or even a *Mnium* identified as a species of *Bryum*. Hagen's connection with our area is confined to the naming of some material from Greenland, which seems to me not to have been exemplary.

As to other treatment of American *Bryum* material by European bryologists, Philibert is credited with meritorious peristome studies and he had the opportunity in higher degree than anyone else to study material from northwestern America, which is still the least understood. Unfortunately the material available to him was somewhat limited and often poor (always excepting that of Williams) and many of his species are of doubtful value or none at all. The same is true in higher degree of Cardot and his col-

laborators and of course, as in other genera, in supreme degree of Kindberg. In the Canadian Arctic, apart from the early species described by Robert Brown, the extensive collections brought back by the second Fram Expedition have especially attracted attention. For *Bryum* Bryhn drew upon the assistance of Ryan, listing a great number of species, including a quite incredible series of "new" ones. Dr. Johannes Lid has been exceedingly kind in allowing me a prolonged study of the Fram collections, which seem to me to show, with the help of considerable more recent collections from the same region, that the *Bryum* flora of the central and eastern American Arctic, including Greenland, is not particularly different from that of northern Europe, except that it is not quite so rich in species, nor is the growth so luxuriant as, for example, in Norway. The species of northwestern America (Yukon and Alaska) differ in some respects, perhaps corresponding more closely with those of adjacent northeastern Asia, but more extensive collecting from this area is highly desirable.

*B. warneum* Bland. of northern Europe has also long been credited to North America, but extensive search for correctly named American specimens has not as yet brought any to light and the species must accordingly be excluded for the present.

*B. Brownii* Br. & Sch. has also been variously credited to North America, should in fact belong there in its type specimen, but as at present understood in Europe is of very doubtful occurrence in America. The facts about it were well and clearly set forth by Williams (Bull. N. Y. Bot. Gard. 2<sup>6</sup>: 123f. 1901) and are quite confirmed by my own findings. Robert Brown described in his *Chloris Mellvilliana* of 1823 4 species presumably of *Bryum* (3 of which he called *Pohlia*) from Mellville Island in arctic America, which should be of fundamental importance for the classification of the arctic *Brya*. Unfortunately he appears to have left no herbarium specimens. What material is in existence from the collections that he studied is scattered, fragmentary and dubious as to the names accompanying it. Furthermore his descriptions are not adequate for a complete identification of Brown's species. The other 3 species (*B. arcticum*, *purpurascens* and *calophyllum*) as now understood by European bryologists apparently occur in America and may then be left as they are, though I have not been able to convince myself absolutely that the present species are the ones originally so named by Brown. The *B. Brownii* of Bruch and Schimper is a new name meant to apply to what Brown had called *Pohlia bryoides* and the new description and plate are obviously based upon the good and abundant material collected by Schimper in the Dovrefjeld of Norway, which Schimper regarded, perhaps erroneously, as identical with Brown's species. Under the circumstances it seems advisable to consider Schimper's Norwegian material the type of his *B. Brownii* and to leave Brown's *Pohlia bryoides* as a doubtful species. Schimper's species is anyhow very closely related to *B. warneum*, as has been noted by Philibert and others, of which it may constitute a montane form with somewhat narrower capsules. Specimens from Greenland labeled *B. Brownii* I have seen, but they are wrongly named.

*B. mammillatum* Lindb. has been reported from Greenland, but no specimen was sent me from Copenhagen, I have seen none otherwise in arctic American material, and its occurrence in America is therefore doubtful.

#### KEY.

1. Inner peristome imperfect, segments rudimentary or lacking..... 2.
- Inner peristome with well developed segments, cilia present or lacking..... 3.
2. Capsule red-brown, broad and short, subglobose, costa percurrent..... 1. *Wrightii*.
- Capsule long on short seta, costa ceasing below apex..... 2. *brachyneuron*.
3. Inner peristome normally without or with very rudimentary cilia..... 4.
- Inner peristome with well developed generally appendiculate cilia..... 16.
4. Outer peristome teeth red, leaves oblong-ovate, rounded at apex..... 3. *Marratii*.
- Outer peristome teeth yellow or brownish yellow, leaves (except in *B. calophyllum*) not rounded at apex..... 5.
5. Outer peristome teeth with ventral lamellae extensively joined by cross-walls and inner peristome adherent..... 4. *pendulum*.
- Outer peristome teeth with ventral lamellae showing slight if any connections by cross-walls and inner peristome slightly if at all adherent..... 6.
6. Leaf cells lax and thin-walled, leaf border strongly differentiated..... 7.
- Leaf cells less lax, border (except in *B. oeneum*) less strongly differentiated..... 10.
7. Operculum small, generally somewhat oblique to the curved capsule..... 8.
- Operculum medium to large, not oblique to the straight or curved capsule..... 9.
8. Inner peristome generally somewhat adherent to outer, segments narrow..... 9. *arcticum*.
- Inner peristome free from outer, segments broad..... 13. *cernuum*.
9. Capsule straight or nearly so, inflorescence normally synoicous..... 10. *purpurascens*.
- Capsule more or less asymmetric or curved, inflorescence dioicous..... 14. *pallens*.
10. Leaf costa decidedly excurrent..... 11.
- Leaf costa normally not excurrent (rarely slightly so)..... 13.

11. Base of outer peristome teeth not showing a conspicuous fundus..... 5. *inclinatum*.  
 Base of outer peristome teeth with conspicuous red fundus..... 12.

12. Seta long, generally much more than 3 cm., spores 35  $\mu$  or more..... 6. *longisetum*.  
 Seta generally below 3 cm., spores 20-30  $\mu$ ..... 7. *archangelicum*.

13. Outer peristome teeth slender below, without ventral longitudinal groove..... 14.  
 Outer peristome teeth broad below, with ventral longitudinal groove..... 15.

14. Capsule short, broad, not curved..... 8. *lacustre*.  
 Capsule curved, with longer neck..... 15. *oeneum*.

15. Leaves rounded or obtuse at apex..... 11. *calophyllum*.  
 Leaves acute at apex..... 12. *acutum*.

16. All parts large, leaf areolation lax and mnioid, leaf-cells exceeding 100  $\mu$  in length..... 38. *Sandbergii*.  
 Leaf cells not exceeding 70  $\mu$  in length..... 17.

17. Plants silvery-white from lack of chlorophyll in cells of upper part of leaves..... 34. *argenteum*.  
 Plants green, sometimes pigmented brown or reddish..... 18.

18. Leaves normally rounded or obtuse at apex..... 19.  
 Leaves mostly acute or acuminate..... 23.

19. Plants minute, capsule oval..... 32. *Blindii*.  
 Plants robust, capsule clavate to pyriform..... 20.

20. Cells of leaf blade thin-walled..... 18. *tortifolium*.  
 Cells of leaf blade with walls somewhat thickened, at least in corners..... 21.

21. Plants light, without red or brown pigmentation, calciphile..... 30. *gemmiparum*.  
 Plants dark, with red and brown tints, not calciphile..... 22.

22. Leaf cells comparatively narrow, 4-6 times as long as broad..... 27. *miniatum*.  
 Leaf cells broader, less than 3 times as long as broad..... 29. *Mühlenbeckii*.

23. Outer peristome teeth light yellow..... 24.  
 Outer peristome teeth dark or brownish yellow, at least in lower part..... 26.

24. Leaves with a strongly differentiated border of narrow cells..... 24a.  
 Leaves with a less strongly marked border or none..... 25.

24a. Synoicous..... 13a. *Biddlecomiae*.  
 Dioicous..... 14. *pallens*.

25. Leaves long-decurrent..... 17. *Weigelii*.  
 Leaves not or very slightly decurrent..... 16. *turbinatum*.

26. Capsule usually dark red, oval to short subcylindrical, with short rounded neck  
 (B. *bicolor* rarely with more elongated neck)..... 27.  
 Capsule more or less elongated with neck gradually narrowing into seta..... 28.

27. Cells of leaf blade small, thick-walled..... 31. *bicolor*.  
 Cells of leaf blade lax, thin-walled..... 33. *coronatum*.

28. Leaf costa normally percurrent or ceasing slightly below apex (in B. *capillare* and  
 B. *bimum* sometimes excurrent)..... 29.  
 Costa of upper leaves regularly excurrent..... 34.

29. Cells of leaf blade relatively lax and thin-walled..... 30.  
 Cells of leaf blade thick-walled..... 31.

30. Arctic species with small imbricate leaves, autoicous, usually sterile..... 20. *teres*.  
 Leaves mostly of good size, contorted when dry, dioicous or rarely synoicous..... 35. *capillare*. ✓

31. Upper leaf cells elongated, up to 6 or 7 times as long as wide..... 28. *alpinum*.  
 Upper leaf cells not elongated, never more than 4 times as long as wide..... 32.

32. Small arctic species..... 19. *nitidulum*.  
 Robust species mostly of lower latitudes..... 33.

33. Pacific coast species, leaves tending to be imbricate when dry, capsule usually red. 26. *crassirameum*.  
 Plant of general distribution, leaves contorted and not imbricate when dry, capsule  
 brown..... 25. *bimum*.

34. Inflorescence autoicous, growing generally in dense cushions of much-branched  
 plants..... 23. *pallescens*.  
 Inflorescence normally synoicous or dioicous..... 35.

35. Inflorescence synoicous..... 36.  
 Inflorescence dioicous..... 37.  
 36. Leaves small, imbricate when dry, lanceolate, with long excurrent toothed costa .. 21. *cirratum*.  
 Leaves larger, ovate-lanceolate, excurrent costa sometimes toothed..... 22. *cuspidatum*.  
 37. Caespitose on surface of ground, upper leaf cells 6 or 7 times as long as wide..... 24. *caespiticium*.  
 Not caespitose, leaves broad, upper cells not more than 3 times as long as broad.. 38.  
 38. Leaves without distinct border..... 36. *canariense*.  
 Leaves bordered by at least 2 rows of narrow cells..... 37. *truncorum*.

1. *BRYUM WRIGHTII* Sull. & Lesq. Proc. Am. Acad. 4: 278. 1860.

*Bryum globosum* Lindb. Öfv. K. Sv. Vet.-Akad. Förh. 23: 546. (1866) 1867.

*Bryum Longii* E. B. Bartr. Rhodora 30: 6. 1928.

Plants closely tufted, with some development of brown radicles below, up to about 1 cm. in height, yellowish green in upper part, becoming reddish brown below; stem slender, erect, simple or sometimes dichotomously branching; leaves not very numerous, more distant below, closely tufted in upper part of stem, erect, subimbricate, broadly ovate, short acuminate, concave, not decurrent, margin entire or nearly so, somewhat reflexed in lower part; costa rather strong, tending to be percurrent in the slightly recurved leaf point; cells of leaf blade very thin-walled, broadly rhomboidal-hexagonal in upper part, up to  $80 \times 25 \mu$ , becoming narrower and longer toward the margin, the final 2 rows very narrow, constituting a distinct border, the cells of basal region tending to be elongated rectangular, several times as long as wide. Inflorescence terminal, synoicous, with hyaline filiform paraphyses; plants then fruiting abundantly; seta slender, red-brown, erect, flexuose, up to 2 cm. in height; capsule normally pendulous, broadly oval-pyriform or subglobose with short neck, which is wrinkled when dry, broad when moist, reddish brown; exothecial cells moderately thick-walled, somewhat rounded-hexagonal, gradually smaller but not much darker-pigmented in 5 or 6 rows at mouth of capsule; stomata numerous in neck, pore slit-like; operculum broad, convex, apiculate; annulus present, removable, hyaline with yellow exterior; peristome delicate, hardly closing effectively the rather broad mouth of capsule; outer teeth inserted at mouth of capsule, slender, broader but not confluent at base, finely papillose, brownish yellow in lower part, paler in the slender nearly filiform apex, the somewhat zig-zag longitudinal divisural line and transverse lines separating the dorsal plates not thick or conspicuous, ventral lamellae not very numerous (about 15), close in lower part, nowhere joined together, distinct but not far projecting, teeth not bordered; *inner peristome a rather low fragile hyaline membrane of somewhat irregular contour, not cohering to outer teeth, showing usually no segments or cilia*, rarely a slender segment; spores round, brown, about  $18 \mu$ , finely punctate, ripening in July or August. Type locality, "Arakamtchetchene Island, Behring's Straits," leg. C. Wright.

ILLUSTRATIONS:—Rhodora 30: pl. 158; Roth, Eur. Laubm. 2: pl. 20, f. 3; Pl. 85 and 86D.

On bare clayey ground in the far north. The type, evidently Asiatic, was collected by C. Wright on the U. S. North Pacific Exploring Expedition under Commanders Ringgold and Rodgers 1853-56. It is still in good condition at Harvard University (duplicate in N. Y. Botanical Garden) and is very clearly the same thing as *B. globosum* Lindb., which it antedates by several years. It is accompanied by one of Sullivant's beautiful (unpublished) drawings, which together with his manuscript description show that he clearly recognized the usually imperfect state of the inner peristome, though he also occasionally found a slender segment, which he likewise illustrated. The illustration of *B. globosum* in Engler & Prantl is quite misleading in this particular, the rudimentary condition of the inner peristome having been noted not only by Sullivant, but also by Lindberg, by Hagen and by Bartram in his description of *B. Longii*. The Mitten Herbarium contains several early arctic American specimens of this species brought by Richardson, Parry and others, it was found by the second Fram Expedition, and has been collected by several recent arctic expeditions. Its present known American distribution extends west to Bernard Harbour, Northwest Territory, south to Newfoundland (*B. Longii*) and Southampton Island in Hudson Bay; it is also known from northern Norway, Spitzbergen and Siberia.

2. *BRYUM BRACHYNEURON* Kindb. Ottawa Naturalist 5: 179. 1892.

*Bryum agattuense* Philib. Rev. Bryol. 28: 35. 1901.

Plants closely tufted or sometimes growing among other mosses, without much development of radicles, rarely over 1 cm. in height, green above, becoming brownish or reddish below; stems more or less erect, thick and fleshy, red, generally branching, often extensively so; stems and main branches show in lower

part a few small distant broadly oval to obovate concave leaves, becoming progressively larger upward, those of the comal region rather large and fairly numerous in a compact rosette, the latter leaves broadly ovate, acute to very short acuminate, hardly decurrent, margin strongly reflexed almost to apex; costa not very strong, generally ceasing considerably below apex; cells of leaf blade thin-walled, tending to be rhomboidal-hexagonal in upper part, up to about  $40 \times 20 \mu$ , becoming somewhat narrower toward margin, but not forming a distinct border, more elongated rectangular toward base. Inflorescence synoicous and apparently also autoicous, fruiting abundantly. Seta short and often rather thick, generally not over 1 cm. in height, curving irregularly or geniculate, slightly reddish; capsule frequently more or less horizontal, sometimes erect or nearly so, or even pendulous, rather large for size of plants, up to 3 mm. in length, elongated pyriform with neck about as long as rest of capsule, light brown; exothelial cells thick-walled, decidedly elongated except as they become gradually shorter in 2 or 3 darker brown-pigmented rows of cells at mouth of capsule; stomata numerous in neck of capsule, phaneropore, guard-cells darker brown, pore slit-like; operculum convex-conical, with short but sharp tip; annulus large, removable, hyaline with yellowish exterior; peristome attached just below mouth of capsule, outer teeth not confluent at base, frequently irregular in shape, gradually narrowing to apex, *blunt at apex even when not broken, or terminating in a hyaline non-papillose portion of irregular contour which is very brittle and easily broken off, not bordered*, pale yellow, a little darker at base, longitudinal divisural line nearly straight and very indistinct, surface minutely papillose, ventral lamellae fairly numerous (over 20) and close, distinct but not far projecting, not interconnected; inner peristome hyaline and extremely fragile, *more or less adherent to outer teeth, sometimes an imperfect and irregularly slit or fenestrated segment can be made out, but no trace of cilia*; spores dark yellow, about  $20 \mu$ , papillose, ripening in late July or early August. Type locality, St. Paul Island in Behring Sea.

ILLUSTRATIONS:—Proc. Wash. Acad. Sc. 4: *pl. 20, f. 2*; Harriman Alaska Series Smithsonian Institution 5: *pl. 37, f. 2; Pl. 85D*.

Besides on St. Paul Island and St. George Island also found on Agattu Island. Reports from farther east in arctic America are based on sterile fragments incorrectly named. An apparently quite distinct species, somewhat suggesting *Plagiobryum* in its general appearance. Kindberg's name, specimens and part of his description evidently apply to the plant described above; the other parts of the description may, as Philibert noted, suggest mixture of other material, but they may equally well represent simple inaccuracy of description. Under the circumstances Philibert might well have corrected the description without applying a new name.

3. *BRYUM MARRATII* Hook. & Wils. in Wils. Bryol. Brit., P. XI. *pl. 32b.* 1855.

*Bryum latifolium* Doz. & Molkenb. Prodr. Fl. Bat. 1851; not Brid. Musc. Recent. Suppl. 4: 120. 1819.  
*Bryum Brinkmanii* A. L. Andr. Bryologist 26: 43. 1923.

Spreading or somewhat tufted on moist ground, with some development of radicles, low, up to 1 cm. in height, yellowish to brownish; stems erect, usually considerably branching with short branches, red, somewhat pentagonal in section with central strand; leaves large, closely placed, erect, little altered in drying, oblong-ovate from a narrow base, not decurrent, very concave with rounded apex, entire, margin slightly reflexed in lower part; costa slender, reddish, ceasing below apex; cells of leaf blade with thick walls which are brown in older leaves, rhomboidal-hexagonal, up to  $70 \times 20 \mu$ , gradually narrowed in a number of rows at margin, forming something approaching a border. Inflorescence autoicous; antheridia and archegonia terminating separate short branches, antheridia rather numerous, paraphyses slender filiform, the antheridial ones more numerous, longer and more brownish or yellowish. Seta slender, generally about 4 cm. in height, sometimes longer or shorter, erect, slightly flexuose, reddish; capsule decidedly pendulous, rather small, generally about 2 mm. in length, oval-pyriform, somewhat asymmetric, light yellowish brown with darker operculum which is small, bluntly conical, neck short and inconspicuous; exothelial cells thin-walled, rather irregular in size and shape, smaller in about 4 rows at mouth of capsule, but not markedly darker-pigmented, though darker peristome may shine through; stomata not numerous, in neck of capsule, phaneropore; annulus well developed, partly brown, removable; outer peristome teeth inserted slightly below mouth of capsule, bright red in lower half, paler above, strong at base with a fundus, papillose, dorsal surface with prominent divisural lines, the longitudinal one nearly straight, ventral lamellae 20-25, low and with irregular transverse connections in lower part of tooth; inner peristome attached to outer, poorly developed with segments narrow and short, not gaping, cilia lacking or very rudimentary; spores yellowish green, roughened, about  $35 \mu$ , ripening in middle of August. Type locality, near Lancaster, England.

ILLUSTRATIONS:—Wils. l. c.; Bry. Eur. *pl. 640*; Braithw. Brit. Moss Fl. 2: *pl. 70 D; Pl. 84*.

Found for the first time in America in 1921 by Mr. A. Brinkman by a spring in a "draw" at Craigmyle, Alberta; later (1929) by Dr. G. J. Ikenberry in a wet place along a creek in open pasture land at Hettinger, North Dakota; otherwise known only from Northern Europe, generally in proximity to the sea. Further study has convinced me that the differences of *B. Brinkmanii* are not so important as I had at first considered them and that it cannot be maintained as a distinct species. The occurrence of this European coastal species in an inland and dry region of America is remarkable. The above description is drawn from Brinkman's specimen.

4. *BRYUM PENDULUM* (Hornsch.) Schimp. Coroll. 70. 1856.

*Ptychostomum pendulum* Hornsch. Flora 5<sup>2</sup>: Syll. 64. 1822.

*Ptychostomum compactum* Hornsch. Flora 5<sup>2</sup>: Syll. 62. 1822.

*Bryum cernuum* Br. & Sch. Bry. Eur. fasc. 6/9: 14, *pl. 331*. 1839; not Lindb. Musc. Scand. 16. 1879 (*Didymodon cernuum* Sw. Musc. Suec. 28, 85. 1799).

*Bryum angustirete* Kindb. Bull. Torr. Bot. Club 16: 94. 1889.

*Bryum Roellii* Philib. Rev. Bryol. 17: 56. 1890.

*Bryum minnesotense* Card. & Thér. Minnesota Bot. Studies 3<sup>12</sup>: 119. 1903.

*Bryum Holzingeri* Card. & Thér. Minnesota Bot. Studies 3<sup>12</sup>: 119. 1903.

*Bryum penduliforme* Bryhn & Ryan, Report 2nd Norw. Arct. Exped. Fram, 11: 114. 1906.

Generally low and closely tufted, mostly about .5 cm. high, densely matted below with brown radicles, generally yellowish green; stem erect, red, extensively branching; leaves small but rather close in lower part of stem, erect-spreading, larger toward summit and arranged closely and spreading in a rosette, when dry with irregularly contorted tips, not decurrent, narrowly ovate-lanceolate with a long-acuminate tip, reddish at base, margin strongly revolute throughout; costa very strong, yellowish, becoming red at base, long-excurrent with a few distant teeth toward apex; cells of leaf blade hexagonal-rhomboidal, around  $50 \times 20 \mu$ , with fairly thick walls and decidedly thickened corners, more rectangular and broader toward base, longer and narrower in narrow apex, also gradually narrowed to a not sharply defined border.

Synoicous, but occasionally showing separate male heads; archegonia and antheridia few in a terminal inflorescence, paraphyses slenderly filiform, hyaline. Seta 2-3 cm. long, erect, slender, reddish brown; capsule horizontal to pendulous, brown or sometimes paler, operculate up to 4 or 5 mm. long, generally narrowly pyriform, passing gradually through a neck often nearly as long as the rest of the capsule into the seta; operculum rather persistent, small, dark in color, narrowed to a projecting point, which may in some cases be oblique; annulus prominent, removable, partly brownish; exothelial cells somewhat irregular, tending to be rectangular and somewhat elongated with thick brown walls, shortened toward mouth of capsule, where some 4-6 rows are decidedly short and darker pigmented with thicker walls, also much shortened in the neck where lie the prominent stomata; outer peristome teeth attached somewhat below mouth of capsule, with fairly distinct fundus, slender, gradually narrowing to apex, brown and opaque in lower half to two-thirds, hyaline above, papillose, narrowly bordered, divisural lines on dorsal surface prominent, longitudinal line nearly straight, dorsal plates averaging about twice as broad as high, lamellae on ventral surface indistinct because of attachment of inner peristome and also because they are themselves irregularly connected by cross-walls of same nature as and projecting equally with themselves; inner peristome coarsely papillose, hyaline with brownish tinge, clinging firmly to outer teeth in lower 2/3 or more, basal membrane about 1/3 its height, segments narrow, rather widely slit below, more narrowly above and two-parted to apex, shorter than outer teeth, cilia, if present, short and imperfect; spores brownish, papillose, varying from 20 to 30  $\mu$  even in the same capsule, ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. *pl. 331*; Braithw. Brit. Moss-Fl. 2: *pl. 70 A; Pl. 84 and 97B*.

EXSICCATI:—Drumm. Musc. Am. 265 (as *B. caespiticium*, in part); Aust. Musc. Appal. 196; Sull. & Lesq. Musc. Bor. Am. 174, (Ed. 2) 262 (as *B. cernuum*); Holz. Musc. Acro. Bor. Am. 171 (in part), 196; Ren. & Card. Musc. Am. Sept. Exsic. 304; Grout, Musc. Perf. 298 (as *B. pallescens*).

Widely distributed on ground and rocks from Greenland and arctic America south to District of Columbia, Pennsylvania, Ohio, Illinois, Missouri, Colorado, Arizona, becoming uncommon in the southern part of its range; also in Europe and Asia. Specimens from arctic America reported as *B. Fridzii* Hagen and *B. confluens* Joergs. appear to be *B. pendulum*.

The peculiar sculpturing of the ventral surface of the outer peristome teeth in this species was studied in detail by Philibert and led to the discovery of connections between the ventral lamellae of the outer peristome teeth in some other species. Caution is necessary in making out this feature, as it is mostly

confined to the species whose inner peristome adheres more or less to the outer and is not always easily dissected away from it. Viewing the outer peristome teeth through the adhering inner peristome, one is easily misled as to actual conditions by the areolation of the inner peristome. As a matter of fact no other species are quite similar to *B. pendulum* in this respect, the lamellae being almost eliminated to form an irregularly sculptured surface. Use of this character as a means of subdividing the genus has proven unsuccessful, as *B. pendulum* is obviously much more closely related to *B. inclinatum*, which has its lamellae quite unconnected, than to the few other species which may show (generally slight) connections between them or some of them.

As to the name, *B. pendulum* can be preserved only arbitrarily as a nomen conservandum. *B. compactum*, which is generally considered a form or variety of it, has page priority over it, but both names had been used before according to Paris: *B. compactum* Dicks. in 1801, a synonym of *Pohlia carneae*; *B. pendulum* no less than three times: for a *Breutelia*, for *Bartramia Halleriana* and for *Leptobryum pyriforme*, for the last of which it is cited as a synonym by Hedwig (1801). The specific name *cernuum* cannot be applied from Hedwig's (1801) *Cynontodium cernuum*, as his description and plate are not identifiable as this species, were in fact meant to cover the *Didymodon cernuum* (sic) of Swartz, which was the species subsequently called *B. uliginosum*. The use of the name *Bryum cernuum* by Bruch and Schimper (1839) was then an erroneous one, as recognized later by Schimper (1856), when he corrected it to *B. pendulum*.

5. *BRYUM INCLINATUM* (Sw.) Sturm, Deutschl. Fl. 2<sup>11</sup>: 14. 1810.

*Pohlia inclinata* Sw. Musc. Suec. 45, 96. pl. 5, f. 11. 1799.  
*Leskia inclinata* Web. & Mohr. Bot. Taschenb. 244, 482. 1807.  
*Cladodium inclinatum* Brid. Bryol. Univ. 1: 621. 1826.  
*Bryum stenorhynchum* C. M. Flora 70: 219. 1887.  
*Bryum acutiusculum* C. M. l. c.: 220. 1887.  
*Bryum edwardsianum* C. M. & Kindb. in Mac. Cat. Can. Pl. 6: 120. 1892.  
*Bryum Froudei* Kindb. Ottawa Naturalist 5: 180. 1892.  
*Bryum minus* Arn. Bihang K. Sv. Vet.-Akad. Handl. 27, Afd. 3, No. 1: 37. 1901.  
*Bryum groenlandicum* Arn. l. c. 39. 1901.  
*Bryum devium* Hag. Meddel. om Grönl. 26: 459 (in part). 1904.  
*Bryum gemmaceum* Bryhn & Ryan, Rep. 2d Norw. Arct. Exped. Fram 11: 83. 1906.  
*Bryum subacutum* Arn. Ark. f. Bot. 15, No. 5: 65. 1917.

Plants densely tufted and considerably matted with brown radicles, generally not more than .5 to 1 cm. high, though remains of the old dead growth may give the tuft a somewhat greater depth, yellowish green to green; stem erect, much branched with short erect innovations, dark red; leaves close, especially in terminal tuft, broadly ovate-lanceolate, erect when moist, slightly distorted in drying, not decurrent, long-acuminate, margin entire and strongly revolute to apex; costa strong, yellowish, generally red at base, excurrent, the tip slightly or not at all toothed; cells of leaf blade hexagonal-rhomboidal, up to  $65 \times 20 \mu$ , walls moderately thick and with somewhat thickened corners, but not pitted, narrowed gradually at edge into a broad border.

Inflorescence terminal, large, normally synoicous, the proportion of antheridia and archegonia varying and occasionally one or the other lacking, paraphyses greenish hyaline and numerous, capsules generally present. Seta slender, 1.5 to 3 cm. high, but varying also above and below these figures, not much twisted, more or less erect, flexuose, straw-colored to reddish; capsule pendulous to subhorizontal, generally elongated pyriform, not curved, lighter to darker brown, averaging 2.5 mm. in length, but varying considerably in size, neck gradually tapering into seta, about  $\frac{1}{2}$  length of rest of capsule, sometimes longer or shorter; operculum rather small, but larger than in *B. pendulum*, solid, brown, short-conical with distinct point; annulus present; exothelial cells thick-walled, irregular in size and shape, tending to be elongated, less so in neck, and gradually shortened in 4 or 5 rows at mouth of capsule, which latter are darker brown pigmented; stomata in neck; peristome inserted close below mouth of capsule, outer teeth yellow, reddish at insertion, slender, finely but distinctly papillose in lower part, coarsely so in long slender more hyaline apex, very slightly if at all bordered, divisural lines on dorsal surface distinct, longitudinal line slightly zig-zag in lower part, nearly straight above, dorsal plates high, hardly twice as broad as high, ventral lamellae distinct and somewhat distant, but not far projecting, not interconnected, somewhat variable in number according to size of capsule and teeth; inner peristome more nearly hyaline, but with yellowish tinge, papillose, not attached to outer, basal membrane low, segments very long and narrow, about equaling length of outer teeth, somewhat appendiculate in slender apex, fenestrate below; cilia present only as rudimentary stubs (up to 3); spores round, up to  $25 \mu$ , or rarely larger, papillose, ripening in summer. Type locality, Sweden.

ILLUSTRATIONS:—Swartz, l. c.; Schwaegr. Suppl. 1<sup>2</sup>: pl. 63; Bry. Eur. pl. 334 (except f. 1<sup>2</sup>); Braithw. Brit. Moss-Fl. 2: pl. 69 F; Pl. 85.

EXSICCATA:—Ren. & Card. Musc. Am. Sept. Exsic. 56.

Growing on wet ground, rocks, etc.; rather common in arctic and subarctic regions across the continent, southward to Maine, Michigan, Colorado, California, not common in the southern part of its range; also in Europe and northern Asia. Variations in size and other characters have led to the making of many related species, whose value is in many cases not clear. The specimen from the 2d Fram Expedition labeled *B. Limprichii* Kaurin which I have seen is apparently to be referred to this species.

6. *BRYUM LONGISETUM* Bland. in Schwaegr. Suppl. 1<sup>2</sup>: 105. pl. 74. 1816.

*Pohlia longiseta* Hüben. Muscol. Germ. 480. 1833.

*Bryum labradorense* Philib. Rev. Bryol. 14: 55. 1887.

Comparable in many of its characters to *B. inclinatum*. Distinguished by its usually very long seta, up to 8 or 10 cm.; capsule about 4 mm. long, prominent annulus, outer peristome-teeth short compared with size of plant and capsule, with only 10-12 lamellae, teeth attached separately below mouth of capsule with very prominent and highly colored reddish fundus; inner peristome with low basal membrane, or if higher often irregularly perforated, segments short and slender, but distinctly fenestrated; spores large, around 40  $\mu$ .

ILLUSTRATIONS:—Schwaegr. l. c.; Roth, Eur. Laubm. 2: pl. 6, f. 9; Pl. 92C.

Growing in swamps and bogs, Dawson, Yukon (Williams), Labrador; also in northern Europe.

7. *BRYUM ARCHANGELICUM* Bry. Eur. fasc. 32: 1, pl. 333. 1846.

*Bryum Graefianum* Schlieph. Flora 68: 364, pl. 6. 1885.

*Bryum salinum* Hag. in Limpr. Laubm. 2: 334. 1892.

*Bryum lapponicum* Kaurin in Jörgensen, Christiania Vid. Selsk. Forh. 1894, No. 8: 76.

*Bryum sublumidum* Limpr. Jörg. l. c. 78.

*Bryum haematostomum* Jörg. l. c. 99.

*Bryum curvatum* Kaur. & Arn. Bot. Not. 1897: 67.

*Bryum retusum* Hag. D. K. Norske Vid.-Selsk. Skr. 1897, No. 2: 11.

*Bryum foveolatum* Hag. Nyt Mag. Naturv. 38: 333. 1900.

*Bryum über* Hag. Meddel. om Grön. 26: 443, pl. 11. 1904.

*Bryum catervarium* Hag. l. c. 446, pl. 12 (in part). 1904.

*Bryum impexum* Hag. l. c. 450, pl. 13. 1904.

*Bryum subfoveolatum* Bryhn & Ryan, Rep. 2nd Norw. Arct. Exped. Fram. 11: 92. 1906.

*Bryum pseudo-Graefianum* Card. & Thér. Calif. Publ. Bot. 2: 301. pl. 28, f. 3. 1906.

*Bryum Kjellmanii* Arn. Ark. f. Bot. 15, No. 5: 63. 1917.

Resembling *B. inclinatum* in gametophyte characters, leaves sometimes broader; inflorescence normally synoicous and capsules produced abundantly; capsule mostly broader, distinctly set off from the narrow neck, but varying in size and shape, neck sometimes curved; operculum generally broader and without sharp point, but varying considerably; outer peristome teeth attached below mouth of capsule and bent inward from the base, the basal attachment separate for each tooth through an enlarged mostly orange to deep red fundus, which is sharply defined and rounded or irregularly curved at its base, the tooth otherwise generally brownish, not bordered, the lamellae close and frequently slightly retuse or emarginate; inner peristome as in *B. inclinatum*; spores 20-30  $\mu$ , often 20-25 or 25-30  $\mu$  within the same capsule, ripening in summer. Type locality, near Archangel, Russia.

ILLUSTRATIONS:—Bry. Eur. pl. 333; Limpr. Laubm. f. 279, 280; Med. Grön. 26: pl. 11, 13; Pl. 93B and 86A.

Growing on sandy ground, rocks, in swamps, etc., frequently near the sea shore, mostly in the high north; known in America from a number of stations stretching from Greenland and Labrador through the central Arctic region to Alaska; also in northern Europe and Asia and to a limited degree in the Alps. Hagen's conception of a separate section *Haematostoma* with numerous species is inflated in the extreme, and it is only after a long study of the very extensive Norwegian and other material in the Hagen Herbarium that I am forced to conclude that there is no specific dividing line between his various species. Even as a species it is pretty close to *B. inclinatum*.

*B. stenodon* Hag., reported by Bryhn & Ryan from Arctic America, rests upon a very uncertain identification of wholly inadequate material. The original *B. stenodon* from Norway belongs at least in part to the above species.

8. BYRUM LACUSTRE Bland. in Sturm, Deutschl. Fl. 2<sup>10</sup>: 13. 1809.

*Hypnum lacustre* Web. & Mohr, Bot. Taschenb. 285. 1807.  
*Mnium lacustre* (Bland. in Exsicc. 1804) Röhl. Deutschl. Fl. 3: 96. 1813.  
*Bryum Knowltonii* Barnes, Bot. Gaz. 14: 44. 1889.  
*Bryum mucronigerum* Philib. Rev. Bryol. 27: 91. 1900.  
*Bryum Dusenii* Arnell, Bih. Svenska Vet.-Akad. Handl. 27, Afd. 3, No. 1: 35, pl. 3 and text fig. 1901.  
*Bryum terrestre* Hag. Musc. Norv. Bot. 142. 1901.  
*Bryum Setchellii* Card. & Thér. Univ. Calif. Publ. Bot. 2: 302. 1906.

Plants densely tufted, with considerable growth of brown radicles in lower part, up to 1 cm. in height, but frequently shorter, yellowish green; stem erect, considerably branched with erect innovations, some of them slender and sterile, conspicuously purplish red; leaves few and distant in lower part, closely tufted in comal region, where they are broadly ovate, acute to very short acuminate, imbricate and not much distorted when dry, slightly spreading when moist, not or slightly decurrent, margin entire and prominently reflexed to apex or nearly so; costa strong, red in basal part, becoming green above, ceasing below or in the apex or very slightly excurrent; cells of leaf blade rhomboidal or rhomboidal-hexagonal in upper part of leaf, up to  $70 \times 20 \mu$ , their walls thin or thickened, at least in corners, sometimes pitted, gradually narrowed and lengthened toward margin, not forming a definitely marked border, much broader and longer (rectangular) toward the base, the final basal ones reddish. Inflorescence terminal, synoicous, both antheridia and archegonia numerous, some of them pigmented reddish, paraphyses filiform, hyaline or with a reddish tinge; seta slender, around 2 cm. long, erect, red when young, becoming reddish-brown when capsules are mature; capsules generally abundant, horizontal to more or less pendulous, obovate-pyriform, yellowish-brown when mature, rather broad in proportion to length, about  $2.5 \times 1$  mm., sometimes larger or smaller, neck short, considerably wrinkled and contracted when dry; capsule itself somewhat wrinkled and distorted when spores have been shed, with conspicuously thin wall, not constricted below orifice, but rather bulging with abrupt contraction toward mouth, this part of capsule normally shining as if varnished; operculum rather small and solid, low conical, rarely present on fully ripe capsules; annulus present; exothelial cells with rather thin but dark walls, somewhat irregular in shape, not much elongated, gradually smaller in some 4 rows at mouth of capsule, the last 2 slightly, but not much, darker-pigmented; stomata in neck; peristome inserted close to mouth of capsule, outer teeth light yellow with more orange-colored insertion, but without a prominent fundus, becoming hyaline in slender tip, finely papillose, hardly bordered, lamellae close in lower part of tooth, not interconnected, dorsal divisural lines obscure, longitudinal one nearly straight, lower dorsal plates rectangular, twice as wide as high; inner peristome yellowish hyaline, papillose, quite free from outer, basal membrane generally low, segments reaching about same height as outer teeth, narrow as to their substance, but rather broadly fenestrated, often split to or at the apex, cilia as 2 or 3 mere stubs or very rudimentary; spores round, greenish yellow, finely papillose,  $15-28 \mu$ , ripening in summer. Type locality, Germany.

ILLUSTRATIONS:—Schwaegr. Suppl. 1<sup>2</sup>: pl. 77; Bry. Eur. pl. 332; Limpr. Laubm. f. 281; Pl. 88.

On the ground in wet places; in a few localities in arctic America, south to Newfoundland; in Europe it reaches southward to the central part, though it is not a mountain species; reported also from Northern Asia. Sturm's figure of *Brýum lacustre* (1809) is not clearly identifiable and like the *Pohlia lacustris* of Hübener (1833) suggests rather *P. Wahnenbergii*, but the illustration of Schwaegrichen (1816 as *Mnium lacustre*), evidently taken from Blandow's material (issued 1804), leaves its identity clear and seems then to justify the citation of Sturm.

## 9. BRYUM ARCTICUM (R. Br.) Br. &amp; Sch. Bryol. Eur. fasc. 32: 2. pl. 335. 1846.

*Pohlia arctica* R. Br. Chloris Mellvilliana 38. 1823.  
*Hemisynapsis arcticum* Brid. Bry. Univ. 1: 606. 1826.  
*Bryum micans* Limpr. Jahresber. d. Schles. Ges. 60: 236. 1883.  
*Bryum arcuatum* Limpr. l. c. 237. 1883.  
*Bryum arcuatum* Kindb. Eur. & N. Am. Bryin. 373. 1897.  
*Bryum tomentosum* Limpr. in Hagen, Musc. Norv. Bot. 208. 1901; not Kindb. Eur. & N. Am. Bryin. 361. 1897.  
*Bryum subrutilans* Kindb. Hedwigia 42: Beiblatt (17). 1903.  
*Bryum aurimontanum* Kindb. Rev. Bryol. 32: 34. 1905.

*Bryum submicans* Kindb. Rev. Bryol. 32: 34. 1905.  
*Bryum laxirete* Bryhn & Ryan, Report 2d Norw. Arct. Exped. Fram 11: 75. 1906.  
*Bryum hyperboreum* Bryhn & Ryan, l. c. 73. 1906.  
*Bryum liliptanum* Bryhn & Ryan, l. c. 78. 1906.  
*Bryum parvum* Bryhn & Ryan, l. c. 79. 1906.

Generally low and closely tufted, up to 1 cm. or more in height, often densely matted below with brown radicles, yellowish green; stem erect, dark red, sometimes branching; upper leaves closely tufted and rather large, quickly expanding in water, erect-spreading when moist, more or less contorted when dry, narrowly ovate, long acuminate, rarely dentate, margin strongly revolute to apex; costa strong, yellow, excurrent in a shorter or longer not markedly toothed point; cells of leaf blade irregularly hexagonal-rhomboidal, thin-walled, around  $50 \times 20 \mu$ , with walls somewhat pitted, cells more elongated and more nearly rectangular toward base, also elongated in acuminate apex, border strongly differentiated, of long narrow cells, sometimes in double thickness. Inflorescence synoicous; archegonia red, antheridia reddish, of about equal length, the numerous paraphyses hyaline, filiform, considerably longer; seta slender, up to 3 cm. high, erect, reddish below, lighter above; capsule inclined to pendulous, curved, clavate-pyriform, passing gradually through the slender neck, which is of about the same length as the rest of capsule, into the very slender summit of the seta, when mature yellowish straw-color, wrinkled when dry, varying in size, up to 4 mm. long; operculum small, light in color, short apiculate, slightly oblique to the capsule; annulus present; capsule-walls thin; exothelial cells irregular in size and shape, tending to be elongated, their walls yellowish, not very thick, abruptly shorter in 3 or 4 rows at mouth of capsule, with thicker walls and darker pigmented, also shortened in collum, where there are numerous stomata; outer peristome-teeth inserted slightly below mouth of capsule, proximate, fairly long with broad base, narrowing gradually to apex, yellow brown in lower  $2/3$  to  $3/4$ , hyaline above, finely papillose in lower part, coarsely so at apex, narrowly bordered in upper part, divisural lines on dorsal surface rather prominent, becoming extremely thick and prominent in upper hyaline part, longitudinal line nearly straight, dorsal plates varying in height, ventral lamellae up to 15 or 20, a few in lower part of tooth sometimes connected by single thin inconspicuous cross-walls; inner peristome hyaline, papillose, sometimes adhering to outer in lower part, segments very narrow, somewhat shorter than outer teeth, with narrow slits along keel, cilia rudimentary or lacking; spores greenish yellow, about  $25 \mu$ , sometimes larger, roughened, maturing in summer. Type locality, Mellville Island in arctic America.

ILLUSTRATIONS:—Schwaegr. Suppl. 3: pl. 272; Bry. Eur. pl. 335 (except f. 1, 1b, 6); Husn. Musc. Gall. pl. 63, f. 7; Pl. 85.

On ground and rocks, frequent in arctic America from Greenland to Yukon and presumably Alaska, not common farther south, most of specimens so named in herbaria being wrongly identified, but extending south in the Rocky Mts. at least to Montana, where characteristic specimens were found by R. S. Williams; also in northern and Alpine Europe and northern Asia. *B. arcuatum* Limpr. represents the extreme form with more robust growth, long seta and elongated capsule with long neck, *B. micans* Limpr. the opposite extreme, with shortened stems, short seta and a rounded, often brown-shining capsule with short neck. All forms connect by all conceivable gradations. *B. arcticum* was certainly present in the material from Mellville Island studied by R. Brown and the name may doubtless be considered as correctly applied.

10. *BRYUM PURPURASCENS* (R. Br.) Br. & Sch. Bry. Eur. fasc. 32: 2, pl. 336. 1846.

*Pohlia purpurascens* R. Br. Chloris Mellvilliana 39. 1823.  
*Bryum serotinum* Lindb. Musc. Scand. 17. 1879.  
*Bryum opdalense* Limpr. Jahresber. Schles. Ges. f. vaterl. Cultur 60: 238. 1883.  
*Bryum autumnale* Limpr. l. c. 239. 1883.  
*Bryum campylocarpum* Limpr. Jahresber. Schles. Ges. 61: 218. 1884.  
*Bryum corioideum* Bryhn & Ryan, Rep. 2d Norw. Arct. Exped. Fram 11: 84. 1906.  
*Bryum semiovatum* Bryhn & Ryan, Rep. 2d Norw. Arct. Exped. Fram 11: 87. 1906.  
*Bryum Pearyanum* Bryhn, Christiania Vid. Selsk. Forh. 1908: No. 5.

Plants gregarious, often growing with other species of *Bryum*, with *Pohlia* or other mosses, with limited development of dark brown radicles, generally reddish, the fruiting stems very low, generally not reaching .5 cm., the sterile shoots longer, sometimes up to 2 cm. Stems dark purplish red to nearly black; leaves of sterile shoots numerous, close, erect-spreading, contorted when dry, sometimes much reduced, more

distant and scale-like, those of fertile stems more closely aggregated, ovate-lanceolate, concave, gradually acuminate, not at all or only slightly decurrent, margin entire and revolute nearly to apex; costa very strong, yellowish, excurrent in short, sometimes slightly denticulate point; cells of leaf blade hexagonal to rhomboidal-hexagonal, broad and lax, up to  $50 \times 20 \mu$ , not greatly altered in base, narrowed next to margin, which is composed of 2 or 3 rows of very narrow elongated cells, only 1 cell in thickness; walls of cells thin to moderately thick with thickened corners, somewhat pitted. Inflorescence terminal, sometimes synoicous, but separate ♂ and ♀ heads are frequent, antheridia purple, archegonia red, paraphyses longer and more numerous in antheridial heads. Seta dark purple-red, rather strong and erect, often much elongated, 2-4 cm. in length. Capsules abundant, horizontal to pendulous, generally elongated obovate-pyriform, sometimes shorter, yellowish brown, not shining, those of the previous year more or less blackened, up to 4 mm. long, slightly contracted below mouth when dry, neck slender, passing gradually into seta, as long as rest of capsule, sometimes curved, capsule-walls notably thick and stiff; operculum rather large, darker brown than capsule, solid and shining, flattened convex, but with mammillate to sharp projecting point, extremely persistent in place, apparently not shed before late fall or winter; annulus present; exothelial cells thick-walled, elongated, gradually shorter in 4 or 5 rows at mouth of capsule, the last 2 rows considerably smaller and darker brown pigmented, those of neck thin-walled, short and irregular, stomata prominent; peristome inserted slightly below mouth of capsule, outer teeth with orange insertion, without prominent fundus, yellow-brown for most of length, becoming hyaline at tip, narrowly bordered in upper part, unusually thick and stiff, strongly incurved when dry, straightening when moist, ventral lamellae fairly numerous and close, unusually prominent in upper part of tooth, dorsal divisural lines unusually prominent, longitudinal line slightly zig-zag, dorsal plates twice or three times as wide as high, papillae dense and appearing when looked at obliquely as if arranged in straight or irregularly curved lines across the tooth; inner peristome also rather strong, finely papillose, brownish yellow except tips of segments, basal membrane rather high, segments slender, erect even when dry, of equal height with outer teeth, strongly carinate with slit-like openings, cilia 2 or 3, rudimentary; spores  $30-35 \mu$ , light yellow, finely papillose, ripe in summer, but apparently shed mostly in autumn or winter. Type locality, Mellville Island in arctic America.

ILLUSTRATIONS.—Schwaegr. Suppl. 3: pl. 272; Bry. Eur. pl. 336; Braithw. Brit. Moss.-Fl. 2: pl. 72A; Roth, Eur. Laubm. 2: pl. 5, f. 4; Pl. 85.

EXSICCATI.—Ren. & Card. Musc. Am. Sept. Exs. 55 (Holz. Musc. Acro. Bor. Am. 224, which illustrates the species very well, was collected by Arnell in Sweden).

On wet ground in the far north. Ren. & Card. 55 is from Labrador. A few specimens were also brought by the 2d Fram Expedition from arctic America. Most of the other American specimens I have seen under this label, except several from Labrador, are wrongly named or very uncertain. The type from Mellville Island I did not find even in the material sent me from the Schwaegrichen Herbarium, though Schwaegrichen's figure seems to correspond with the conception of the species held by later European bryologists. The Bry. Eur. plate is obviously from Schimper's Norwegian material. The purplish color of the leaves, from which the species takes its name, has often proved misleading, as it is not always present and on the other hand may be equally or more prominent in other species under the strong insolation of the northern summer. *B. autumnale* and *B. opdalense*, of which I have seen type material, are larger and smaller forms respectively of the species (the latter having a short-necked capsule), standing in the same relation to the normal form as *B. arcuatum* and *B. micans* to *B. arcticum*. Numerous Norwegian specimens called *B. opdalense* by Hagen show all sorts of transitional forms. The so-called striation of the dorsal surface of the outer peristome-teeth is also not a very important character: the prominent papillae, viewed from a certain direction, may appear to be arranged somewhat in rows. Besides in America the species occurs only in northern Europe and Asia.

### II. BRYUM CALOPHYLLUM R. Br. Chloris Mellvilliana 38. 1823.

*Cladodium calophyllum* Brid. Bry. Univ. 1: 622. 1826.

*Pohlia calophylla* Schwaegr. Sp. Musc. 75. 1830.

*Bryum latifolium* Br. & Sch. Bry. Eur. fasc. 6/9: 19, pl. 339. 1839; not (Schwaegr.) Brid. Musc. Recent. Suppl. 4: 120. 1819.

*Bryum cyclophyloides* Bryhn & Ryan, Rep. 2d Norw. Arct. Exped. Fram, No. 11: 108. 1906.

*Bryum paganum* Bryhn & Ryan, I. c. 109. 1906.

Plants gregarious or loosely tufted, sometimes growing with other mosses, up to 1 cm. or more in height, with limited growth of radicles in lower part, yellowish to reddish brown; stem more or less erect,

slender, branching, the fruiting branches very short, the sterile shoots more elongated, often reddish or brownish; leaves of sterile shoots generally small, somewhat distant, spreading-incurved when dry, erect-spreading when moist, those of fruiting branches much larger, brownish, less numerous and more aggregated, but otherwise similar; all broadly ovate (except narrower perichaetal leaves), very concave, very obtuse or rounded at apex, entire or slightly crenulate toward apex, those of fruiting branches with revolute margin in their lower part; costa strong, brownish, generally ceasing a short distance below apex, sometimes percurrent; cells of leaf blade short and broad, hexagonal to rhomboidal in upper part, up to  $50 \times 25 \mu$ , with rather thick very slightly pitted walls, becoming larger and more rectangular toward base, gradually narrower toward margin, leaving an obscurely differentiated border of from 1 to rarely 3 rows of cells. Inflorescence terminal on short branch, considered autoicous, but plants frequently show only the ♀ branch, generally fruiting, seta red or reddish, up to 3 or more cm. long, stiffly erect and only slightly twisted; capsule pendulous, about 2 mm. long, obovate with a short thick neck less than half the length of rest of capsule, brown when ripe; operculum large, reddish brown when ripe, low-conical with projecting point, of solid consistency and rather persistent in place; annulus present; cells of exothecium very thick-walled, irregular in size and shape, somewhat elongated, gradually shortened in 6 or 7 rows at mouth of capsule, the last rows very much flattened and somewhat darker pigmented, stomata confined to the short neck; peristome inserted close below mouth of capsule; outer peristome-teeth incurved when dry, light yellow and rather broad below, becoming hyaline in slender tip, finely papillose, hardly bordered, dorsal divisural lines very indistinct, longitudinal one somewhat zig-zag, dorsal plates 2 or 3 times as broad as high, ventral lamellae numerous and prominent, the tooth itself having a conspicuous longitudinal ventral furrow; inner peristome yellow, slightly papillose, with low basal membrane, segments slender and slightly slit, cilia lacking or rudimentary, sometimes developed to some length; spores brownish-yellow,  $25-35 \mu$ , granular, ripening in summer or early fall. Type locality, Mellville Island in arctic America.

ILLUSTRATIONS:—*Bry. Eur.* *pl. 339*; *Limpr. Laubm. f. 278*; *Braithw. Brit. Moss-Fl. 2: pl. 70 E*; *Roth, Eur. Laubm. 2: pl. 12, f. 7; Pl. 87*.

On wet ground in Greenland and arctic America; also in northern Europe and Asia. That Robert Brown's species, in lack of a certain type, has been correctly interpreted is perhaps subject to question, and one finds in American herbaria under this name not infrequently other species, especially *B. tortifolium*. It is nowhere common. The ventral lamellae of the outer peristome-teeth are not retuse or emarginate as often in *B. archangelicum*, but instead the tooth itself has a ventral longitudinal furrow as correctly shown by Limpricht's figure of the cross-section of the tooth. The term "aulacodontous" has been loosely used to cover both conditions, which have no necessary connection with each other and at any rate correspond to no close relationship so far as these two species are concerned.

12. *BRYUM ACUTUM* Lindb. *Meddel. Soc. Faun. Flor. Fenn. 13: 239.* 1886.

*Bryum acutiforme* Limpr. in Hagen, *Musc. Norv. Bor. 156.* 1901.

*Bryum Treleasei* Philib. *Rev. Bryol. 28: 35.* 1901.

*Bryum brachythecium* Bryhn & Ryan, *Rep. 2d Norw. Arct. Exped. Fram 11: 81.* 1906.

*Bryum Lowii* Kindb. *Rev. Bryol. 34: 91.* 1907 (in part).

*Bryum Myliusii* Hesselbo, *Meddel. om Grönland 43: 174.* 1910.

Very closely related to the last species. Differs in the sometimes longer stems, the leaves more erect and appressed, acute or even acuminate, with costa sometimes excurrent, leaf border more pronounced. Inflorescence sometimes synoicous. Capsule when ripe tending to be distinctly red; outer teeth of peristome not so broad below and tapering gradually to slender apex, narrowly bordered, with less prominent ventral furrow and more prominent orange-colored fundus; inner peristome segments nodulose or almost appendiculate in long slender tip; spores  $35-40 \mu$ . Type locality, Russian Lapland.

ILLUSTRATIONS:—*Proc. Wash. Acad. Sc. 4: pl. 20*; *Harriman Alaska Series 5: pl. 37*; *Roth, Europ. Laubm. 2: pl. 7, f. 3; pl. 18, f. 6; Pl. 98C*.

Known from a few stations in arctic America, from Greenland to Alaska; also in northern Europe and Asia. Both Arnell and Hagen reported the occasional occurrence of synoicous plants, Hagen trying to segregate them in the species *B. acutiforme*. I find however, his material of *B. acutiforme* from the type-locality quite agreeing with his material of *B. acutum*. It may be added that there is reasonable doubt whether *B. acutum* is really specifically distinct from *B. calophyllum*, but I have not been able to demonstrate clearly such identity in the material at my disposal.

## 13. BRYUM CERNUUM (Sw.) Lindb. Musc. Scand. 16. 1879.

*Didymodon cernuum* Sw. Musc. Suec. 28, 85, *pl. 1, f. 2.* 1799.  
*Pohlia uliginosa* Bruch in Brid. Bry. Univ. 1: 841. 1826.  
*Cladodium uliginosum* Brid. l. c. 1826.  
*Bryum uliginosum* Br. & Sch. Bry. Eur. fasc. 6/9: 18, *pl. 339.* 1839.  
*Bryum conditum* R. S. Williams, Bull. N. Y. Bot. Gard. 2: 125. *pl. 18.* 1901.  
*Bryum campiocarpum* Card. & Thér. Bot. Gaz. 37: 374. 1904.

Plants generally loosely tufted, rarely over 1 cm. in height, with some development of brown radicles in lower part, green or slightly yellowish or brownish; stems slender, erect but often somewhat flexuose, green or slightly reddish in lower part, branching from near base; leaves not numerous, somewhat distant and evenly placed on stem, erect but considerably contracted and flexuose when dry, erect-spreading when moist, rather large, particularly as to length, which may be up to 5 mm., hardly decurrent, the basal attachment narrow, narrowly ovate-lanceolate, long acuminate and slightly toothed at apex, hardly revolute at margin; costa strong, yellowish, percurrent or short excurrent; cells of leaf blade rather large and thin-walled, hexagonal-rhomboidal, up to  $75 \times 25 \mu$  in upper part of leaf, considerably narrowed and elongated toward base, margin strongly differentiated, of up to 4 or 5 rows of long, narrow cells, sometimes of double thickness. Inflorescence normally autoicous and fruiting abundantly: the male heads (like the female) terminal on short branches, inconspicuous and hard to demonstrate, with few small antheridia and few short and slender paraphyses. Seta erect, long and slender, sometimes up to 5 or 6 cm. in height, reddish below, paler in upper part; capsule varying from suberect to horizontal or subpendulous, in American specimens mostly very long and slender, clavate and more or less arcuate, up to 6 mm. in length, light brown when mature, neck slender and gradually tapering into slender seta, sometimes longer than the rest of capsule; operculum small, shining, rather permanent in place, generally low-conical, sometimes longer pointed; annulus present; exothecial cells small and thick-walled, tending to be rather regularly rounded-rectangular, slightly longer than wide, becoming isodiametric some 8 or 10 rows from mouth of capsule, the last 4 or 5 rows thicker-walled, more pigmented brown, the last 1 or 2 rows very thick-walled and flattened, those of capsule-neck short and irregular; stomata confined to neck of capsule; outer peristome-teeth strongly incurved when dry, yellow, broad below, generally narrowing above to a long, slender point, papillose, dorsal divisural lines very distinct and papillose, longitudinal one zig-zag, dorsal plates in lower part 3 or 4 times as broad as high, ventral lamellae numerous, prominent and close together in lower part of tooth; inner peristome lighter yellow, with somewhat distant papillae, basal membrane high, segments rather wide except at narrow apex, narrowly slit along keel, cilia if present short and more or less coherent; spores round, brownish yellow, about  $25 \mu$ , papillose, ripening June to September. Type locality, Sweden.

ILLUSTRATIONS:—Swartz, l. c.; Bry. Eur. *pl. 339*; Braithw. Brit. Moss-Fl. 2: *pl. 70c*; Roth, Eur. Laubm. 2: *pl. 12, f. 9; Pl. 87.*

EXSICCATA:—Drumm. Musc. Am. 267 (as *B. turbinatum* var. *pallens*); Aust. Musc. Appal. 191; Sull. & Lesq. Musc. Bor. Am. 175, (2nd Ed) 263.

On wet ground, widely distributed across the continent, but nowhere very common, reaching southward to New York, Ohio, Illinois, Texas, New Mexico, Oregon, northward to Yukon and Newfoundland; also in Europe and Asia. American specimens tend to have longer and narrower capsules than European ones, otherwise there is close agreement. Later use of the specific name *cernuum* for other species, notably *B. pendulum*, appear to rest upon mistaken conceptions of Swartz' species and should not invalidate it.

## 13a. BRYUM BIDDLECOMIAE Aust. Bot. Gaz. 2: 110. 1877.

*Bryum erubescens* Kindb. in Mac. Cat. Can. Pl. 6: 118. 1892.

Plants closely tufted, sometimes growing with other mosses, low, hardly more than .5 cm. high, green or with a reddish or brownish tinge; stems erect, extensively branching, including slender subflagelliform branches; leaves closely arranged, erect when moist, somewhat undulate-contorted when dry, ovate to slightly obovate, acuminate, strongly reflexed or revolute at margin, serrulate toward apex; costa strong, yellowish green, excurrent; cells of leaf blade lax with thin non-pitted walls, tending to be elongated hexagonal, up to  $50 \times 25 \mu$ , with a plainly marked border of 2 or more rows of long narrow cells. Inflorescence synoicous, capsules abundant. Seta slender, up to 2 cm. high, reddish; capsule pendulous, light straw-color, pyriform, broad in proportion to length,  $3 \times 1.5$  mm. or even shorter in some cases, neck slender, shorter than rest of capsule, operculum fairly large, convex or low conical, blunt; annulus present; exo-

thelial cells small, thick-walled, irregular in shape, some slightly elongated, becoming smaller toward mouth of capsule, the last 2 rows flatter and darker pigmented; stomata in neck; outer peristome teeth yellow, rather broad at base, bordered above, finely papillose, dorsal divisural lines indistinct, ventral lamellae numerous and close; inner peristome lighter in color, papillose, basal membrane high, segments not very broad, irregularly fenestrated, cilia originally described as lacking, but some appendiculate cilia are normally present; spores brownish yellow, papillose, around  $18 \mu$ , ripening in summer. Type locality, Alma, Park County, Colorado.

ILLUSTRATION:—*Pl. 84.*

So far as known at present the species is endemic to the Rocky Mt. region. The original collector is not known with certainty; Miss Biddlecome had received it from a Mrs. Haines, who may have received it from someone else, but the locality was plainly marked. The material is in good condition and considerable quantity both in the Austin and Rau herbaria. The locality for *B. erubescens* was Lake Louise, collected by J. Macoun, Aug. 18, 1891. Good material has also been collected by Paul C. Standley in Glacier National Park, Montana, Aug. 1919.

14. *BRYUM PALLENS* Sw. *Musc. Suec.* 47, 98, pl. 4, f. 12. 1799.

*Hypnum pallens* Web. & Mohr., *Bot. Taschenb.* 286. 1807.

*Bryum fallax* Milde, *Rabenh. Bryoth. Eur.* No. 242 (with diagnosis). 1859.

*Bryum hydrophyllum* Kindb. *Bull. Torr. Club* 16: 95. 1889.

*Bryum meesioides* Kindb. *Bull. Torr. Club* 16: 95. 1889.

*Bryum subpurpurascens* Kindb. *Mac. Cat. Can. Pl.* 6: 119. 1892.

*Bryum anectangiaceum* C. M. & Kindb. *Mac. Cat.* 6: 130. 1892.

*Bryum drepanocarpum* Philib. *Proc. Wash. Acad. Sc.* 4: 322, *pl. 18, f. 1.* 1902.

*Bryum heterogynum* Philib. *I. c.* 320, *pl. 19, f. 2.* 1902.

Plants generally loosely tufted, sometimes more gregarious or scattered or intermixed with other mosses, 1 cm. in height or sometimes more or less, with slight development of brown radicles in lower part, green to more or less strongly pigmented red; stem slender, erect, red, sometimes branching by new shoots from basal part; leaves small, few and distant in lower part, larger, more numerous and tufted in apical region, erect and somewhat distorted when dry, erect to erect-spreading when moist, obovate, gradually acuminate, normally entire, revolute at margin, somewhat decurrent; costa strong, brownish, percurrent; cells of leaf blade rather large and very thin-walled, irregularly hexagonal, up to  $50 \times 25 \mu$  or larger, marginal border strongly differentiated, sometimes of a double layer of very narrow cells. Inflorescence dioicous, but male plants generally growing among others, sometimes very numerous, and capsules generally produced; antheridial plants similar to others, with large terminal head containing numerous more or less reddish antheridia and numerous filiform paraphyses which are considerably longer than the antheridia. Seta slender, erect, not much twisted, of very variable length, up to 3 cm. or more; capsule nodding to subpendulous, averaging about 3.5 mm. in length, elongated pyriform, almost always curved, light yellowish when mature, the old deoperculate capsules often very dark, neck tending to be about as long as rest of capsule, in some cases shorter, in others greatly lengthened; operculum of same color as capsule, rather quickly shed when mature, rather large, low conical to convex, with sharp point; annulus present; exothelial cells thick-walled, roughly rectangular and mostly longer than wide, shortened toward mouth of capsule, the last 4 or 5 rows markedly shortened, the last 2 somewhat darker pigmented; stomata numerous in neck of capsule, pore slit-like; peristome inserted close to mouth of capsule, outer teeth yellow, incurved when dry, erect when moist, narrowing gradually to apex, papillose, dorsal divisural lines distinct, not far projecting, longitudinal one almost straight, strongly thickened toward apex of tooth, ventral lamellae close, numerous and far projecting; inner peristome yellow, sometimes somewhat adherent to outer, with fairly high basal membrane, segments rather slender, narrowly slit along keel, cilia variable, normally appendiculate, sometimes less well developed or almost lacking; spores yellow, finely roughened, small,  $18-22 \mu$ , ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Swartz, I. c.; *Bry. Eur.* pl. 373; Philib. I. c.; Braithw. *Brit. Moss-Fl.* 2: pl. 73E; Roth, *Eur. Laubm.* 2: pl. 18, f. 10; pl. 12, f. 6; M. H. M. f. 112.

EXSICCATA:—Aust. *Musc. Appal.* 202 (as *B. Duvalii*); Holz. *Musc. Acro. Bor. Am.* 44, 321, 429 (as *B. meesioides*), 605; Grout, *Musc. Perf.* 146.

In wet places, from the far north southward across the continent to northern New England, New York, Montana, Washington; also in Europe and Asia. The specific separation of *B. fallax* on the basis of

less developed cilia of the inner peristome is hardly justified, as has been realized by many bryologists. The case of *B. oeneum* of Blytt (originally spelled *aeneum* in *Bry. Eur.*) with its leaf-cells showing thick, pitted walls might seem to be different, and after study of a great deal of material, including that of Blytt, I am treating it as a separate species, though with some misgivings. Our far western specimens often show a slender, long-necked, arcuate capsule deceptively suggestive of *B. cernuum*.

15. *BRYUM OENEUM* Blytt, *Bry. Eur. fasc. 32: 4, pl. 338.* 1846.

Generally compared with *B. pallens* and like it dioicous. Differs in its dense growth with plants up to 3 cm. high, leaves more numerous and uniform along whole length of stem, of more solid substance, leaf cells with thicker walls, which are decidedly pitted, also thickened corners. Filiform septate propagula sometimes produced in leaf axils. Capsules often lacking, when present with smaller operculum and less well-developed peristome, the outer teeth more brownish-yellow in lower part, slender, coarsely papillose, lamellae less numerous, the inner peristome coarsely papillose, sometimes somewhat adherent to outer, with low basal membrane, which may be irregularly perforated, the segments narrow and often with irregular outline, cilia rudimentary, the spores brownish, larger, papillose, around  $25 \mu$ . Type locality, Norway.

ILLUSTRATIONS:—*Bry. Eur. pl. 338*; Roth, *Eur. Laubm. 2: pl. 12, f. 5; Pl. 93A.*

Occasional in Greenland and arctic America, where it is mostly sterile; also in northern Europe and Asia. There is a good deal of question whether the differences of this species may not be due to conditions of environment rather than of specific nature; on examination of a great deal of material they do not all maintain themselves consistently. The name *B. rutilans* Brid. sometimes used for this form was published already with a question mark and seems too uncertain to adopt, especially as complicated by another later *B. rutilans*.

16. *BRYUM TURBINATUM* (Hedw.) Schwaegr. *Suppl. 1<sup>2</sup>: 109.* 1816.

*Mnium turbinatum* Hedw. *Stirpes Crypt. 3: 27, pl. 8.* 1792.

*Hypnum turbinatum* Web. & Mohr, *Taschenb.* 282. 1807.

*Bryum Schleicheri* Schwaegr. *Suppl. 1<sup>2</sup>: 113, pl. 73.* 1816.

*Mnium latifolium* Schleich. Schwaegr. *Suppl. 1<sup>2</sup>: 138.* 1816.

*Bryum latifolium* Brid. *Musc. Recent. Suppl. 4: 120.* 1819.

*Bryum extenuatum* Ren. & Card. *Bot. Gaz. 15: 57.* 1890 and *Bull. Soc. Bot. Belg. 29: 152.* 1890.

*Bryum denticulatum* Kindb. *Bull. Torr. Club, 17: 273.* 1890.

*Bryum haematophyllum* Kindb. in *Mac. Cat. Can. Pl. 6: 118.* 1892.

*Bryum erythrophyllum* Kindb. in *Mac. Cat. Can. Pl. 6: 131.* 1892.

*Bryum turgens* Hag. *Kgl. Norsk. Vid. Selsk. Skr. 1897, No. 2: 20.*

*Bryum grandirete* Kindb. *Eur. & N. Amer. Bryin. 353.* 1897.

*Bryum submuticum* Philib. *Bull. N. Y. Bot. Gard. 2, No. 6: 127.* 1901.

*Bryum suborbiculare* Philib. *I. c. 128.* 1901.

*Bryum pseudo-Stirtoni* Philib. *Proc. Wash. Acad. Sc. 4: 321.* 1902.

*Bryum Harrimani* Card. & Thér. *Proc. Wash. Acad. Sc. 4: 322.* 1902.

*Bryum anceps* Card. & Thér. *Bot. Gaz. 37: 371.* 1904.

*Bryum distantifolium* Card. & Thér. *Bot. Gaz. 37: 373.* 1904. (*B. erythrophyloides* Kindb. in herb.)

*Bryum languidum* Hag. *Meddel. om Grönl. 26: 462.* 1904.

*Bryum cyclophyloides* Kindb. *Rev. Bryol. 32: 37.* 1905.

Somewhat variable in gametophyte characters. Plants more or less densely tufted, 2 cm. in height, sometimes less, often much elongated, particularly in its sterile forms, often matted with brown radicles in lower part, nearly always yellowish; stems erect, sometimes flexuose in elongated forms, red, pentagonal in section with central strand, branching by new shoots from basal part; leaves numerous and generally closely placed, erect-spreading when moist, more appressed and often somewhat contorted when dry, ovate-lanceolate to more broadly ovate, acuminate, in the elongated forms sometimes obtuse, sometimes slightly serrulate in apical region, margin slightly reflexed in lower part, only slightly if at all decurrent; costa very strong, yellowish to brownish, excurrent; cells of leaf-blade thin-walled, rather large,  $70 \times 20 \mu$ , or wider in proportion to length in case of broader-leaved forms, gradually narrower toward border region, forming a not strongly differentiated border, cells much broader in basal part, up to  $30 \mu$  or more, where they are nearly rectangular. Inflorescence dioicous, sometimes fruiting abundantly, at others, particularly in the elongated large-leaved forms, sterile; antheridia numerous in a large bud-like terminal head, paraphyses

numerous, filiform, longer than antheridia; seta slender, erect, somewhat flexuose, up to 4 cm. or more in length, reddish; capsule generally pendulous, operculate, up to 3.5 mm. or more long, tending to be broad-pyriform, not curved or asymmetric, yellowish brown when mature, neck about as long as rest of capsule, gradually contracting into seta, capsule constricted below mouth in drying; operculum rather large, convex with small apiculus, often remaining for some time attached to capsule; annulus present; exothelial cells thick-walled, somewhat irregular in shape, tending to be slightly elongated, thinner-walled and more nearly isodiametric in some 8 or more rows at mouth of capsule, those of neck broader in proportion to length; stomata in neck; peristome inserted near mouth of capsule, outer teeth yellow, gradually narrowing to apex, narrowly bordered, densely papillose, dorsal divisural lines distinct but not far projecting, longitudinal line strongly zig-zag, ventral lamellae numerous and close, not far projecting; inner peristome yellow, papillose, basal membrane high, about half height of peristome, prominently articulated, segments moderately wide, broadly fenestrated, contracting to a long narrow point, cilia in 3's, generally shorter than segments, somewhat coherent, more or less appendiculate; spores small, around 15  $\mu$ , brownish yellow, papillose, ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Hedw. l. c.; Schwaegr. l. c.; Bry. Eur. pl. 372; Braithw. Brit. Moss Fl. 2: pl. 74A; Pl. 88B.

EXSICCATI:—Drumm. Musc. Am. 264, 266 (in part); Sull. & Lesq. Musc. Bor. Am. 190, (Ed. 2) 287; Holz. Musc. Acro. Bor. Am. 322, 348.

In wet places, from the far north southward in our western states to California and New Mexico; reports from our eastern states seem to rest upon wrong identification of mostly sterile plants. The leaves vary greatly in size and width, which has led to a considerable synonymy; they tend to be of a yellowish color and to respond quickly to soaking in water. Though most authors associate this species with *B. pallens*, it is doubtful if there is any very close relation between them.

According to Hagen's interpretation *B. neodamense* Itzg. has been wrongly understood by European bryologists as being closely related to *B. ventricosum* and belongs rather in proximity to *B. turbinatum*. Bryhn & Ryan in treating the mosses of the 2d Fram Expedition evidently followed Hagen, for the specimens which I have seen named by them *B. neodamense* belong with *B. turbinatum*. In the same way specimens from the 2d Fram Expedition which I have seen placed under *B. Stirtoni* Schimp. and *B. elegans* Nees (both should be forms of *B. capillare* L.) are quite similar forms of *B. turbinatum*.

17. *BRYUM WEIGELII* Spreng. Mant. Prim. Flor. Halensis, Add. 55. 1807.

*Bryum Duvalii* Voit in Sturm, Deutschl. Fl. 2: Hft. 12: 10. 1811.

*Mnium Duvalii* Schwaegr. Suppl. 1: 126, pl. 79. 1816.

*Bryum leucobasis* Kindb. Rev. Bryol. 36: 99. 1909.

Plants loosely tufted, up to 3 cm. or more in height, generally light green, with slight growth of brown radicles in lower part; stem erect, generally more or less flexuose, yellowish green, pentagonal in section with central strand, often branching by new shoots from just below the inflorescence; leaves relatively small, not numerous, distant, arranged at more or less regular intervals on the elongated stem, irregularly contorted when dry, erect-spreading when moist, ovate to ovate-lanceolate, long decurrent, acute to acuminate, margin entire, not reflexed or very slightly so in lower part; costa slender, yellowish green, ceasing slightly below apex or percurrent; cells of leaf blade thin-walled, in upper part narrowly hexagonal, up to 50 x 20  $\mu$ ; rectangular below, narrowed toward margin but generally without distinct border. Inflorescence dioicous and rarely fruiting; antheridial heads large, terminal, antheridia and paraphyses numerous, the latter filiform; seta slender, erect, around 3 cm. high, reddish to yellowish brown; capsule pendulous, operculate up to 3.5 mm. long, obovate-pyriform, not curved, yellowish brown, a narrow ring about the mouth shining, neck broader and shorter than in the preceding species; operculum large, convex with small apiculus, remaining for some time attached to capsule; annulus present; in other characters not differing greatly from *B. turbinatum*; exothelial cells near mouth thick-walled; peristome attached well below mouth of capsule; spores as small as 10  $\mu$ , light yellow and only very slightly roughened, maturing in summer. Type locality, Europe.

ILLUSTRATIONS:—Sturm, l. c.; Schwaegr. l. c.; Bry. Eur. pl. 371; Braithw. Brit. Moss Fl. 2: pl. 73 F; Roth, Eur. Laubm. 2: pl. 18, f. 8; M. H. M., f. 111; Pl. 89B.

EXSICCATI:—Aust. Musc. Appal. Suppl. 514; Sull. & Lesq. Musc. Bor. Am. 189, (Ed. 2) 286; Holz. Musc. Acro. Bor. Am. 44, 319.

In wet places, from the far north to northern New England and New York and to Colorado in the west; also in Europe and Asia. Elongated sterile forms of various other species showing slightly decurrent

leaves are often confused with it. It is obviously most closely related to *B. turbinatum*, as generally recognized, but I have not been able to regard it as a mere form of that species. The specific name *Weigelii* has, as Limprecht noted, priority over *Duvalii*.

18. BRYUM TORTIFOLIUM Funck in Brid. Bryol. Univ. 1: 844. 1826.

*Mnium cyclophyllum* Schwaegr. Suppl. 2: 160. pl. 194. 1827.

*Bryum cyclophyllum* Br. & Sch. Bry. Eur. fasc. 6/9: 63. pl. 370. 1839.

*Bryum obtusifolium* Lindb. Öfvers. K. Sv. Vet.-Akad. Förh. 23: 544. 1867; not Vill. Pl. Dauph. 3: 882. 1789; nor Turn. Musc. Hibern. 116, pl. 11, f. 1. 1804.

*Bryum subneodamense* Kindb. Rev. Bryol. 32: 34. 1905.

Plants loosely or closely tufted, the year's growth hardly surpassing 2 cm., but for northern specimens the total growth of several years sometimes reaching a height of 7 or 8 cm., green or yellowish green or variously red-pigmented, with a considerable development of brown radicles, frequently also with clusters of yellow, filiform, septate propagula in the leaf-axils; stems erect or irregularly flexuose with branches innovating from the comal region, pentagonal in section with central strand; leaves of fair size, somewhat distant, crisped and contorted when dry, spreading when moist, ovate to oval or nearly round from a narrow base, which is narrowly decurrent, rounded at apex, margin entire, plane; costa rather slender, green, ceasing below apex; cells of leaf-blade thin-walled, rhomboidal in upper and middle part, up to  $35 \times 20 \mu$ , longer and rectangular toward base, narrower toward margin, where they may form something of a border, which however does not reach apex. Inflorescence dioicous and rarely fruiting. Capsules not seen on American specimens; described as similar to those of the last 2 species. Type locality, Europe.

ILLUSTRATIONS:—Schwaegr. l. c.; Bry. Eur. pl. 370; Braithw. Brit. Moss Fl. 2: pl. 75D; Roth, Eur. Laubm. 2: pl. 18, f. 1; pl. 5, f. 5; Pl. 89A.

EXSICCATA:—Aust. Musc. Appal. 192.

In wet places, rare or not commonly collected, Greenland and arctic America south to New Jersey, Pennsylvania and Wisconsin, in the west to British Columbia; also in Europe and Asia. Apart from the frequent red pigmentation of the essentially arctic *B. obtusifolium* of Lindberg, I can see nothing to distinguish it specifically from the plants lacking such pigmentation; if recognized as distinct, its name must be changed because of its earlier use for other species. The name *tortifolium* seems to have clear priority over *cyclophyllum* and was applied to the same material of Funck.

Kindberg's report of *B. subobtusifolium* C. M. is apparently to be referred to this species.

19. BRYUM NITIDULUM Lindb. Öfvers. K. Vet.-Akad. Förh. 23: 545. (1866) 1867.

*Bryum dawsonense* R. S. Williams, Bull. N. Y. Bot. Gard. 2: 124. 1901.

*Bryum angustidens* Bryhn & Ryan, Rep. 2nd Norw. Arct. Exped. Fram. 11: 86. 1906.

*Bryum cancelliforme* Bryhn & Ryan, l. c. 89. 1906.

*Bryum Simmonsi* Bryhn & Ryan, l. c. 94. 1906.

*Bryum nodosum* Bryhn & Ryan, l. c. 97. 1906.

*Bryum glomeratum* Bryhn & Ryan, l. c. 99. 1906.

Plants densely tufted, low, rarely reaching 1 or 2 cm. through growth of several years, new growth yellowish green, brown below and matted with brown radicles; stem red, erect with short erect innovations; leaves not very numerous, lower ones small and separate, upper aggregated and somewhat larger, erect, not greatly changed in drying, broadly ovate to oval, acute, entire, concave, margin revolute; costa strong, reddish in lower part, percurrent or nearly so, in upper leaves sometimes slightly excurrent; cells of leaf-blade small, up to  $30 \times 15 \mu$ , hexagonal-rhomboidal, with rather thick pitted walls, in basal part of leaf larger, more nearly rectangular and reddish, at margin narrowing gradually into a border. Inflorescence synoicous, terminal, capsules generally present, often abundant, seta slender, reddish, often flexuose, generally less than 2 cm.; capsule rather small, up to 2.5 mm. long, pendulous, oval-pyriform, light brown, often shining near mouth, neck short, passing gradually into seta; operculum sometimes rather long and subrostrate, shining; annulus present; exothelial cells elongated, thick-walled, shorter in about 6 rows at mouth of capsule, the last rows darker brown pigmented, also short in neck, which contains the stomata; peristome inserted close below mouth of capsule, outer teeth brownish yellow, strong, gradually narrowing to apex, finely papillose, narrowly bordered, dorsal divisural lines distinct, but not far projecting, longitudinal line nearly straight, dorsal plates in lower part 3 or 4 times as wide as high, ventral lamellae numer-

ous, sometimes joined by thin cross-walls; inner peristome lighter yellow, finely papillose, basal membrane about  $\frac{1}{3}$ , segments slender but rather widely fenestrated, cilia 2 or 3, shorter or longer, but frequently decidedly appendiculate; spores brownish yellow, 15-25  $\mu$  or somewhat larger, ripening in summer. Type locality, Spitzbergen.

ILLUSTRATIONS:—Bull. N. Y. Bot. Gard. 2: pl. 17 (as *B. dawsonense*); 86B. Besides in Spitzbergen found in several stations in Greenland and arctic America. Seems to be related to *B. lacustre*, with a more highly developed peristome.

20. *BRYUM TERES* Lindb. Öfvers. K. Vet.-Akad. Förh. 23: 545. (1866) 1867.

*Bryum densum* Bryhn & Ryan, Rep. 2nd Norw. Arct. Exped. Fram 11: 103. 1906.

Plants very densely tufted, low or sometimes elongated up to 1 or 2 cm., upper parts yellowish green, becoming brown below, matted with brown radicles; stem red, erect, often considerably branching with erect brittle innovations; leaves numerous and rather close, even imbricate, not much changed in drying, not decurrent, small, very concave, broadly oval, nearly as wide as long, generally short apiculate, the apiculus sometimes slightly reflexed, entire or slightly crenulate toward apex, margin not reflexed; costa strong to slender, generally ceasing below apex; cells of leaf blade relatively large and thin-walled, irregularly hexagonal-rhomboidal, up to 35 x 20  $\mu$ , more nearly rectangular in basal part, not forming a border, walls slightly if at all pitted. Inflorescence terminal, autoicous, capsules rarely produced, none seen on American specimens. A fruiting Siberian specimen from the Lindberg herbarium shows a red flexuose seta, thick in lower part, about 1.5 cm. high, light brown pendulous capsule, which is obovate-pyriform with short neck; exothecial cells moderately thick-walled, not much elongated, but tending roughly to a square shape and arranged in longitudinal series, the last 3 or 4 rows at mouth of capsule strongly flattened but not darker-pigmented, those of neck generally broader than long; peristome inserted close to mouth of capsule, insertion orange, outer teeth brownish yellow, gradually narrowed to apex, narrowly bordered in upper part, densely papillose, dorsal divaricating lines prominent, longitudinal line nearly straight, lower dorsal plates not more than 3 times as wide as high, ventral lamellae not very numerous, rather far projecting; inner peristome hyaline, irregularly papillose, basal membrane high, segments short and narrow, narrowly fenestrated, cilia delicate and short, tending to be appendiculate; spores described as small, ripening in summer. Type locality, Spitzbergen.

ILLUSTRATIONS:—Pl. 98B.

An arctic species, not common and not generally fruiting; reported from the 2d Fram Expedition as common, but the majority of its specimens which I have seen under this name belong to various other species; the only one I can place here is No. 2634 from North Devon. Greenland material received from the herbarium of the Botanical Museum in Copenhagen shows a few fairly characteristic specimens.

*B. subnitidulum* Arn. in the original specimen from Jan Mayen is probably *B. nitidulum*, as Arnell himself suggested, but the specimens from Greenland and King Oscar's Land brought back by the 2d Fram Expedition named *B. subnitidulum* appear to belong rather to *B. teres*. Greenland specimens published as *B. comense* Schimp. and *B. veronense* De Not. appear to belong, at least in part, to *B. teres*.

21. *BRYUM CIRRATUM* Hoppe & Hornsch. Flora 2: 90. 1819.

*Bryum lonchocarpon* C. M. Flora 58: 93. 1875.

*Bryum leucomatum* C. M. & Kindb. Mac. Cat. Can. Pl. 6: 123. 1892.

*Bryum revolutum* Kindb. Rev. Bryol. 23: 22. 1896.

*Bryum producticolle* Kindb. Eur. & N. Am. Bryin. 364. 1897.

*Bryum mamilligerum* Kindb. Eur. & N. Am. Bryin. 364. 1897.

*Bryum columbico-caespiticium* Kindb. Hedwigia 42: Beibl. 16. 1903.

*Bryum polycladum* Card. & Thér. Bot. Gaz. 37: 370. 1904.

*Bryum longicolle* Card. Rev. Bryol. 36: 114. 1909.

Plants densely tufted, generally not more than 1 cm. high, yellowish or yellowish green, closely matted with brown radicles; stem red, more or less erect with short innovations; leaves small, close, imbricate when dry, erect and slightly spreading when moist, lanceolate with a very long drawn out point, not decurrent, strongly revolute at margin, slightly serrulate near apex; costa very strong, reddish at base, yellowish green or sometimes brownish above, long excurrent with distinct teeth near its tip; cells of leaf

blade with moderately thin and only slightly pitted walls, thickened at corners, elongated hexagonal-rhomboidal, about  $50 \times 15 \mu$  in middle portion, longer and narrower in slender apex, toward base much broadened, hyaline or reddish tinted, nearly rectangular, the alar ones shortened to quite square, the revolute margin (above the base) consisting of 4 or 5 or more rows of very narrow cells. Inflorescence normally synoicous and fruit regularly abundant, antheridia and archegonia not numerous, paraphyses filiform and longer. Seta generally long and slender, up to 5 or 6 cm., reddish, not much twisted; capsule inclined to pendulous, comparatively large, operculate up to 5 mm. long, yellowish brown, obovate-pyriform with neck generally shorter, but sometimes as long as rest of capsule, broad, contracting in folds when fully ripe, capsule contracting below mouth in drying; operculum rather large, rounded convex with distinct point; annulus prominent; exothelial cells thick-walled, irregularly rectangular, shortened in 4 or 5 rows toward mouth of capsule, the last 2 rows markedly flattened, also short and irregular in neck with numerous stomata; peristome inserted below mouth of capsule, outer teeth with a bright orange base dark yellow above, broad below, tapering abruptly above to the slender apex, narrowly bordered, finely papillose, dorsal divisural lines slender but fairly distinct, longitudinal line zig-zag, dorsal plates narrow, 2 or 3 times as wide as high, ventral lamellae very numerous, close and rather prominent, not interconnected; inner peristome light yellow, finely granular papillose, its basal membrane high,  $\frac{1}{2}$  or more the height of peristome, segments strongly keeled and broad, except in slender tip, very broadly fenestrate; cilia generally in 3's, prominently appendiculate; spores brownish yellow, papillose, about  $15 \mu$ , ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—*Bry. Eur.* *pl. 357*; *Roth, Eur. Laubm.* **2**: *pl. 12, f. 1; Pl. 95*.

EXSICCATI:—*Holz. Musc. Acro. Bor. Am.* **116**, **172**; *Grout, Musc. Perf.* **252** (atypical).

In moist places on rocks and soil, extending southward in the United States only in the western states to New Mexico and California, the most eastern specimens seen being those of Holzinger from Minnesota; also in Europe and Asia. This is not so closely related to *B. intermedium* as to *B. cuspidatum* and the following group of somewhat critical species. With us it appears to be the most distinct of the group both as to characters and distribution. In Europe some bryologists treat it as an alpine form of *B. cuspidatum*.

*Bryum intermedium* (Ludw.) Brid. is a distinct and well understood European species which has also long been credited to America. I have however not yet seen an American specimen correctly referable to it and must conclude that it is not represented on this continent. What is generally taken for it by American botanists is the species variously known as *B. cuspidatum* Schimp. or *B. affine* (Bruch) Lindb. The mistake goes back to the early American bryologists, who in this case as in others, depended upon Schimper and the *Bryologia Europaea*. But Schimper had not recognized the latter species as (doubtfully) distinct before the appearance of the 2nd edition of his *Synopsis* in 1876, the *Bry. Eur.* referring to it only as an unimportant variety of *B. bimum*. There being then no place for these common specimens which American bryologists recognized as distinct from *B. bimum*, whose var. *cuspidatum* they perhaps overlooked, they were placed in *B. intermedium* and the confusion has continued even after the recognition of *B. cuspidatum* (*affine*).

*Bryum microstegium* Br. & Sch. has been reported from Greenland, but so far as I can see on the basis of a questionable identification. I am inclined to doubt that the species itself is really separable from *B. intermedium*; certainly it is not well understood,—the herbarium of Hagen contains under this name very diverse Norwegian material.

22. *BRYUM CUSPIDATUM* (Br. & Sch.) Schimp. *Syn. (Ed. 2)* **430**. 1876.

*Bryum bimum* β *cuspidatum* Br. & Sch. *Bry. Eur. fasc. 6/9*: 50. 1839.

*Webera affinis* Bruch in Brid. *Bryol. Univ.* **1**: 848. 1826 (nomen nudum).

*Bryum affine* Lindb. (as subspecies) *Musc. Scand.* **16**. 1879.

*Bryum flagellosum* Kindb. *Eur. & N. Am. Bryin.* **356**. 1897.

*Bryum polare* Hag. *Meddel. om Grön.* **15**: 398. 1898.

*Bryum alaskanum* Kindb. *Mac. Cat. Can. Pl.* **7**: 247. 1902.

*Bryum hemicuspis* Kindb. *Hedwigia* **42**: Beiblatt **16**. 1903.

*Bryum Berggrenii* Hag. *Meddel. om Grön.* **26**: 453, *pl. 13, f. i-r* (in part). 1904.

*Bryum decens* Hag. l. c. **457**, *pl. 14, f. a-h.* 1904.

*Bryum nano-caespiticium* Kindb. *Rev. Bryol.* **34**: 92. 1907.

*Bryum neomexicanum* Card. *Rev. Bryol.* **36**: 113. 1909.

*Bryum Manitobae* Kindb. *Rev. Bryol.* **37**: 15. 1910.

Closely related to the preceding and following species. Plants closely tufted and short, hardly surpassing 1 cm. in height, green, radiculose; stems branching with few innovations; leaves ovate-lanceolate

with long narrow point, closely arranged in a rosette-like head; costa strong and more or less long-excurrent in a point which may be toothed. Inflorescence synoicous and fruit regularly present. Seta slender and flexuose, up to 2.5 cm. long; capsule horizontal to inclined or subpendulous, brown, hardly exceeding 3 mm. in length, constricted below orifice when dry, neck generally shorter than rest of capsule; outer peristome teeth tapering gradually to a slender apex, brownish-yellow below, hyaline above, dorsal divisural lines distinct and prominently projecting, longitudinal line nearly straight, both peristomes strongly papillose; spores brownish-yellow, papillose, around 14  $\mu$ , ripening in early summer. Type locality, Europe.

ILLUSTRATIONS:—Roth, Eur. Laubm. 2: pl. 12, f. 2; Pl. 92B.

EXSICCATI:—Aust. Musc. Appal. 193 (as *B. intermedium*); Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 277 (as *B. intermedium*); Holz. Musc. Acro. Bor. Am. 428 (in part).

On wet rocks and in their crevices, sometimes on decayed wood or ground. Might be conceived of as a xerophytic form of *B. bimurum*, but I have not been able to convince myself from study in field and herbarium that it must be reduced to that species. It is generally distributed throughout the United States and far northward (also in Europe and Asia), common in the east, where it has been taken for *B. intermedium* as noted above. The specific name *affine* was not adequately published and should then be dropped. Schimper stated that the *Pohlia paradoxa* of Hübener (1833) was the same as his *B. cuspidatum*, but Hübener's description does not correspond and the name *Bryum paradoxum* was preempted (Schwaegr. 1827). Both names, *B. affine* and *B. cuspidatum*, had also been used earlier for *Mnium* species as well as in other genera. Greenland specimens placed by Hagen under the doubtful species *B. Culmannii* Limpr. appear to belong to *B. cuspidatum*.

23. *BRYUM PALLESCENS* Schleich. in Schwaegr. Suppl. 1<sup>2</sup>: 107. pl. 75. 1816.

*Bryum contextum* Hoppe & Hornsch. Flora 2: 91. 1819.

*Bryum subrotundum* Brid. Bryol. Univ. 1: 673. 1826.

*Bryum microstegioides* Kindb. Ottawa Nat. 14: 88. 1900.

*Bryum teretinerme* Bryhn & Ryan, Rep. 2nd Norw. Arct. Exped. Fram, No. 11: 104. 1906.

Closely related to the several preceding and following species. From *B. cirratum* differs essentially in the following particulars; growing in very dense cushions often of several cm. in depth, made up of a much branched matted mass of short yearly innovations, green or yellowish green, the leaves broader, spirally twisted when dry, ovate-lanceolate to triangular or nearly so, also long-acuminate, but less extremely so, the costa not so strong, but also excurrent in the upper leaves, its tip generally not denticulate, though the apical part of the leaf is often slightly serrulate; cells of leaf blade comparatively shorter and thicker-walled. Inflorescence normally autoicous, ♂ and ♀ terminal on separate branches. Seta mostly shorter and more flexuose, generally not more than 2 cm. long; capsule pale and shorter, generally not more than 3 or 3.5 mm. in length; operculum smaller, darker than rest of capsule and shining, somewhat persistent in place; peristome attached well below mouth of capsule; lamellae of outer peristome-teeth not far projecting, sometimes tending to be slightly retuse; spores ripening in May or June or later according to altitude and latitude. Type locality, Europe.

ILLUSTRATIONS:—Schwaegr. l. c.; Bry. Eur. pl. 359, 369; Braithw. Brit. Moss Fl. 2: pl. 71D; Roth, Eur. Laubm. 2: pl. 15, f. 11; Pl. 90B.

EXSICCATI:—Ren. & Card. Musc. Am. Sept. Exs. 57, 58; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 279.

In moist places on rocks and soil, in the United States, not uncommon in the western states, where it occurs as far south as Arizona, but becomes more common northward and in Canada and the arctic regions extends across the continent and to Greenland, south to Ohio and apparently northern New York and New England, but is very uncommon in our northeastern states, reports sometimes being based on wrongly identified material; also in Europe and Asia.

The name *Bryum boreale* (Web. & Mohr.) Schwaegr. would have priority, but if identical its description by Weber & Mohr is inaccurate and there is too much doubt about it to justify substituting it for the other name, which is clear.

24. *BRYUM CAESPITICUM* L. Spec. Pl. 1121 (in part). 1753.

*Mnium caespiticium* Hedw. Fund. 2: 94. 1782.

*Hypnum caespiticium* Schrank, Baier. Fl. 2: 473. 1789.

*Bryum vancouverense* Kindb. Bull. Torr. Club 16: 95. 1889.

*Bryum synoico-caespiticium* C. M. & Kindb. Mac. Cat. Can. Pl. 6: 128. 1892.

*Bryum oligochloron* C. M. & Kindb. Mac. Cat. Can. Pl. 6: 129. 1892.

*Bryum microcephalum* C. M. & Kindb. Mac. Cat. Can. Pl. 6: 134. 1892.

*Bryum julaceum* Kindb. Rev. Bryol. 34: 91. 1907.

Plants closely cespitose on surface of ground, sometimes merely gregarious or mixed with other mosses, rarely exceeding 1 cm. in height, generally less, light green, becoming brownish in lower parts, with abundant growth of brown radicles; stems slender and somewhat rambling, often considerably branched, red, pentagonal in section with central strand; the lower leaves distant, delicate and small, long-lanceolate, the upper larger, aggregated in a rosette-like head, ovate-lanceolate with long acumination, margin strongly revolute, entire or very slightly serrulate in apex; costa strong, red at base, yellowish above, generally long-excurrent in a smooth or slightly toothed point; cells of leaf blade with thin and non-pitted walls, all considerably elongated and narrow, rhomboidal,  $70 \times 10 \mu$ , somewhat longer and narrower toward apex and margin, but without strongly differentiated marginal cells, broader and shorter in base, the alar ones nearly square. Inflorescence dioicous, the male plants sometimes closely associated with female and capsules produced abundantly; antheridia numerous in a terminal head, with numerous longer filiform, sometimes reddish, paraphyses. Seta strong but somewhat flexuose, red or reddish at least in lower part, up to 3 cm. in height; capsule inclined to pendulous, sometimes curved, up to 4 mm. long, often shorter, clavate to obovate, yellowish-brown, constricted under the orifice in drying, neck shorter than rest of capsule; operculum short conical; annulus present; exothelial cells thick-walled, tending to be somewhat elongated rectangular, 4 or 5 rows at mouth of capsule shortened and darker pigmented; stomata in neck; peristome inserted near mouth of capsule, outer teeth dark yellow, orange at base, tapering abruptly in upper part to the slender apex, finely papillose, bordered, dorsal divisural lines distinct and prominent, longitudinal line zig-zag, dorsal plates 2 or 3 times as wide as high, ventral lamellae numerous, rather close and prominently projecting; inner peristome hyaline, its surface finely roughened, basal membrane high, segments very wide, abruptly narrowing toward apex, broadly fenestrated, cilia appendiculate; spores small,  $7-10 \mu$ , light yellow, nearly smooth, maturing generally in May or June. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 374; Braithw. Brit. Moss Fl. 2: pl. 71E; M. H. M. f. 113.

EXSICCATI:—Aust. Musc. Appal. 197; Sull. Musc. Allegh. 98; Sull. & Lesq. Musc. Bor. Am. 191, 192; (Ed. 2) 288, 289; Holz. Musc. Acro. Bor. Am. 245, 349, 396; Ren. & Card. Musc. Am. Sept. 60.

Mostly on the ground, on poor soil, widely distributed in the United States and northward; also in Europe and Asia and reported from northern Africa. It is also closely related to the several preceding species and often found confused with some of them in herbaria.

25. BRYUM BIMUM Schreb. Spic. Flor. Lips. 83. 1771.

*Bryum ventricosum* Dicks. Crypt. Fasc. 1: 4. 1785.

*Mnium pseudotriquetrum* Hedw. Stirpes Crypt. 3: 19. pl. 7. 1792.

*Mnium bimum* Brid. Muscol. Rec. 3: 93. 1803.

*Hypnum pseudotriquetrum* Web. & Mohr, Bot. Taschenb. 288. 1807.

*Bryum pseudotriquetrum* Schwaegr. Suppl. 1<sup>2</sup>: 110. 1816.

*Bryum neodamense* Itzigsohn in C. Muell. Syn. 1: 258. 1848.

*Bryum haematoxarpum* C. Muell. & Kindb. in Macoun, Cat. Can. Pl. 6: 125. 1892.

*Bryum euryloma* Card. & Thér. Bot. Gaz. 30: 20. 1900.

*Bryum crispulum* Hampe in Hagen, Musc. Norv. Bor. 205. 1901.

*Bryum cylindrico-arcuatum* Philib, Proc. Wash. Acad. Sci. 4: 319. pl. 18, f. 2. 1902.

*Bryum brevicuspis* Card. & Thér. Bot. Gaz. 37: 373, pl. 22, f. 3. 1904.

*Bryum dimorphophyllum* Card. & Thér. Bot. Gaz. 37: 375. 1904.

*Bryum subpercurrentinerve* Kindb. Rev. Bryol. 32: 37. 1905.

Plants generally closely tufted, sometimes growing among other mosses, often considerably elongated, up to 7 or 8 cm. (several years' growth), dark green or tinged with red, sometimes completely purple, much matted with brown radicles; stems stiffly erect, red, pentagonal in section with central strand, not much branching; leaves numerous, arranged along stem, more distant below, closer in apical part, erect-spreading when moist, irregularly twisted and contorted when dry, ovate-lanceolate, gradually acuminate, slightly to considerably decurrent, margin entire, reflexed throughout; costa strong, red at base, yellowish to brownish green above, percurrent or slightly excurrent; cells of leaf blade with moderately thick and pitted walls, hexagonal-rhomboidal, up to  $50 \times 15 \mu$ , elongated-rectangular toward base, the basal ones red, the alar

short and broad, nearly or quite square, the margin with a distinct border of several rows of long narrow cells with thick walls. Inflorescence synoicous or dioicous, sometimes varying in the same tuft, archegonia red above, antheridia often reddish tinged, paraphyses numerous, longer, filiform, hyaline. Seta up to 4 or more cm. high, strong, dark purple and sometimes geniculate at base, somewhat lighter, more slender and flexuose above; capsule inclined to pendulous, rather long, up to 6 mm., clavate, generally straight, brown, neck tending to be as long as rest of capsule; operculum large, rounded with a prominent point, brown, shining; annulus present; exothelial cells thick-walled, tending to be slightly elongated rectangular, shortened toward mouth of capsule, the last 4 or 5 rows being markedly transversely flattened and darker brown pigmented, those of neck also short and irregular, stomata in neck; peristome inserted slightly below mouth of capsule, outer teeth somewhat distant, brownish yellow, darker at insertion, tapering more rapidly in upper part, bordered, finely papillose, dorsal divisural lines distinct but fine and not very prominent, longitudinal line in part zig-zag, in part nearly straight, dorsal plates 2 or 3 times as wide as high, ventral lamellae numerous, close and rather far projecting; inner peristome light yellow, papillose, basal membrane high, up to  $\frac{1}{2}$  or more, segments broad, keeled and broadly fenestrated, cilia prominently appendiculate; spores brownish-yellow, roughened, around 14  $\mu$ , maturing in summer. Type locality, Europe.

ILLUSTRATIONS:—*Bry. Eur.* *pl. 363, 364*; *Braithw. Brit. Moss.*—*Fl. 2: pl. 71A, 74B*; *Roth, Eur. Laubm. 2: pl. 12, f. 4, pl. 18, f. 7*; *M. H. M. pl. 47*.

EXSICCATI:—*Drumm. Musc. Am.* 268; *Aust. Musc. Appal.* 194, 195, 200, 201; *Sull. Musc. Allegh.* 97; *Sull. & Lesq. Musc. Bor. Am.* 184 (in part), 186, (Ed. 2) 278, 281; *Holz. Musc. Acro. Bor. Am.* 222, 223, 246, 317, 347; *Allen, Mosses of the Cascade Mts.* 61, 146; *Grout, Musc. Perf.* 134, 270.

In wet and swampy places, on ground and rocks, rarely on decayed wood, throughout the United States and northward; also in Europe and Asia; said to occur at various localities in the southern hemisphere. As *B. bimum* and *B. ventricosum* (*B. pseudotriquetrum*) do not differ apart from the inflorescence and this at times varies even within the same tuft, I have not felt that they should be separated taxonomically. *B. bimum* is the older name.

26. *BRYUM CRASSIRAMEUM* Ren. & Card. *Bot. Gaz.* 15: 57. *pl. 8B.* 1890;  
also *Bull. Soc. Bot. Belg.* 29: 154. *pl. 5B.* 1890.

*Bryum aciculinum* Kindb. *Eur. & N. Am. Bryin.* 355. 1897.

Plants closely tufted, up to 4 cm. in height, the year's growth hardly above 2 cm., brownish green, generally matted with brown radicles; stem very strong and stiff, erect, branching irregularly with erect innovations; leaves numerous, closely arranged, often imbricate when dry, sometimes somewhat contorted, erect-spreading when moist, clinging tenaciously to stem, broadly ovate-lanceolate, obtuse to acute, the upper ones sometimes slightly acuminate, margin revolute to near apex, entire or slightly subserrulate near apex; costa strong, especially in base, where it may be reddish or brownish, generally percurrent; cells of leaf blade with thick and pitted walls throughout, more or less hexagonal-rhomoidal in upper part, up to  $50 \times 15 \mu$ , becoming more nearly rectangular toward base, but not elongated or hyaline, the marginal cells gradually narrower, forming a more or less distinct border. Inflorescence dioicous, male plants generally associated with female and capsules present, but not in great numbers; antheridia terminal in a swollen head, very numerous, brownish-yellow; paraphyses filiform, of same color, only slightly longer than the antheridia. Seta rather strong and long, not much twisted, up to 3 cm. or more in height, reddish at least in lower part; capsule subpendulous, inclined or horizontal or sometimes suberect, slenderly clavate, up to 7 mm. long, tending to a distinctly reddish coloration, which is sometimes lacking in immature or other specimens, the neck often as long as the rest of capsule, gradually contracting to seta; operculum brown, shining (as is also a ring about mouth of capsule), conical with prominent point; annulus present; exothelial cells and peristome characters as in *B. bimum*; spores yellow, slightly roughened, 10-12  $\mu$ , maturing in spring or summer. Type locality, Oregon City, Oregon (leg. Henderson).

ILLUSTRATIONS:—*Bot. Gaz.* and *Bull. Soc. Bot. Belg.* 1. c.; *Pl. 94B.*

EXSICCATI:—*Allen, Mosses of the Cascade Mts.* 61b (as *B. pseudotriquetrum*), 62a (as *B. Atwateriae*); *Holz. Musc. Acro. Bor. Am.* (et *Eur.*), 395, 604.

Wet rocks and ground by streams, Pacific coastal region from British Columbia to northern California, inland to Montana. This species has somewhat the appearance of the following group, but is obviously a derivative of *B. bimum* (*B. ventricosum*), with which it was compared in the original description. It is possible that it does not merit specific distinction from the latter. On the other hand it leads over in some degree toward the following species, with which it often grows and with which it is sometimes confused in herbarium and exsiccati specimens.

## 27. BRYUM MINIATUM Lesq. Mem. Acad. Calif. 1: 23. 1868.

*Bryum Atwateriae* C. M. Bull. Torr. Club 5: 35. 1874.  
*Bryum Macouni* Aust. Bot. Gaz. 2: 110. 1877.

Plants generally densely tufted, in robust specimens up to 5 cm. high, sometimes quite low and stunted, usually but not always showing coloring of pink, red or purple, not matted with radicles; stem strong, stiff, erect, branching occasionally with erect branches, red or brown; leaves numerous, very closely arranged, imbricate when dry, slightly erect-spreading when moist, clinging tenaciously to stem, from a narrow base oblong or oblong-ovate, very concave, rounded at apex, rarely obtuse or subacute, not decurrent, margin plane, entire; costa very strong, brown or brownish, ceasing slightly before or at apex; cells of leaf blade with notably thick but hardly pitted walls, more strongly thickened in corners, tending to be elongated rhomboidal, up to  $60 \times 10 \mu$ , narrower toward margin, but without clearly defined border, not greatly different toward base, except that the very base is made up of thick, short brown cells. Inflorescence dioicous, generally fruiting sparsely or not at all; antheridia in an inconspicuous terminal bud, very numerous, brownish, with numerous brownish filiform paraphyses, which are slightly longer than the antheridia. Seta stout, flexuose, not much twisted, dark purplish red, up to 2.5 cm. high; capsule pendulous or inclined, generally slender, clavate, mostly strongly reddened, but the red color sometimes lacking, up to 5 mm. long, the neck rarely as long as rest of capsule, tapering gradually to seta, operculum conical, pointed, dark reddish brown, shining, as is also a ring about mouth of capsule; annulus present; walls of capsule thick, exothecial cells thick-walled, roughly elongated-rectangular, becoming gradually shortened toward mouth of capsule, stomata in neck; peristome inserted slightly below mouth of capsule, outer teeth separate, brownish-yellow, not notably darker at insertion, lighter in slender tip, which tapers more rapidly but somewhat irregularly, narrowly bordered, finely papillose, dorsal divaricating lines fine, but prominently projecting, longitudinal line nearly straight, dorsal plates 3 or 4 times as wide as high, the tooth thin in cross-section, ventral lamellae numerous and close, prominently projecting; inner peristome yellow, finely papillose, basal membrane high, about half height of whole, segments keeled but much narrower than in the previous group of species, less broadly and somewhat irregularly fenestrated, cilia appendiculate; spores brownish-yellow when mature, papillose, up to  $18 \mu$ , maturing in summer. Type locality, Yosemite Valley, California.

ILLUSTRATIONS:—*Pl. 91B.*

EXSICCATI:—Aust. Musc. Appal. Suppl. 512; Allen, Mosses of the Cascade Mts. 62; Holz. Musc. Acro. Bor. Am. 426 (partly *B. crassirameum*), 603; Ren. & Card. Musc. Am. Sept. 59.

On wet rocks by or in brooks, etc., in the Pacific coastal region from British Columbia to California, inland to Montana. Closely related to *B. alpinum*, perhaps a derivative of it, but clearly enough distinct. *Pohlia faeroensis* C. Jens. from the Faroe Islands was declared by Kindberg to be identical with this species and after examining an authentic specimen in the herbarium of the New York Botanical Garden I should agree entirely that it is quite the same.

28. BRYUM ALPINUM Huds. Fl. Angl. 415. 1762; Brid. Musc. Recent. 2<sup>o</sup>: 30. 1803.

*Mnium alpinum* Sw. Meth. Musc. 28. 1781.

*Bryum laurentianum* Card. & Thér. Proc. Wash. Acad. Sci. 4: 320, *pl. 19, f. 3.* 1902.

Plants densely tufted, often up to 5 cm. or more in height through several years growth, green, shading more or less into red or brown, with slight growth of radicles; stem strong, stiff, erect, not much branching, innovating from below apex, red or brown, pentagonal in section with central strand; leaves closely appressed when dry, not much spreading when moist, numerous and closely arranged, mostly narrowly lanceolate, tapering to a long sharp apex, very slightly decurrent, margin reflexed, entire; costa very strong, brownish green to reddish, normally percurrent, in some leaves ending slightly below apex, in others slightly excurrent; cells of leaf blade narrow in upper part of leaf, irregularly rhomboidal, up to  $60$  or  $70 \times 10 \mu$  with moderately thick and hardly pitted walls, becoming shorter and broader toward base, where they approach a square shape with thin walls, not showing a clearly marked border. Inflorescence dioicous, rarely fruiting; antheridia said to be terminal on an otherwise undifferentiated stem. Seta flexuose, purplish, 1.5 cm. in height; capsule inclined or subpendulous, small, clavate to elongated pyriform, operculate up to 2.5 mm. or slightly more in length, dark red, the neck as long as rest of capsule or slightly shorter; operculum dark red-brown, shining, conical or convex with point; annulus present. Other characters essentially as in last species; spores maturing in summer. Type locality, Europe.

## BRYACEAE

ILLUSTRATIONS:—Bry. Eur. *pl. 380*; Braithw. Brit. Moss Fl. **2**: *pl. 73D* (except 1); *Pl. 90A*.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. **195**, (2nd Ed.) **293**.

On wet rocks and ground, not frequent or not frequently collected in America, southward to the White Mts. of New Hampshire, Montana, Idaho and California, also in Europe and Asia.

**29. BRYUM MÜHLENBECKII** Br. & Sch. Bry. Eur. fasc. **32**: **11**, *pl. 381*. 1846.

*Bryum Rauei* Aust. Bot. Gaz. **2**: **110**. 1877.

*Bryum pygmaeo-alpinum* C. M. & Kindb. in Mac. Cat. Can. Pl. **6**: **126**. 1892.

*Bryum rubicundulum* C. M. & Kindb. in Mac. Cat. Can. Pl. **6**: **129**. 1892.

Plants densely tufted, up to 3 cm. or more high, sometimes small and short, dark with red and brown tints, considerably matted with dark purplish-brown radicles; stem stiff and strong, normally erect with erect branches, red or brown; leaves numerous, closely and evenly arranged, imbricate when dry, erect-spreading when moist, clinging tenaciously to stem, oblong-ovate, broad and slightly decurrent at base, very concave, obtuse to subacute at apex, margin somewhat reflexed, entire; costa strong, red or reddish, percurrent; cells of leaf-blade with moderately thick and somewhat pitted walls, irregularly hexagonal-rhomboidal, rather broad and short, up to  $50 \times 20 \mu$ , narrower toward margin without a clear border, short rectangular to square in whole basal part. Inflorescence dioicous, not often fruiting; antheridia terminal in a bud-like head, numerous, brownish when mature, paraphyses numerous, brownish, filiform, longer than antheridia. Seta stout below, slender above, purplish-brown, rather short, rarely reaching 2 cm.; capsule pendulous, obovate-pyriform, rather small, up to 3 mm. in length, dark red-brown, the neck about as long as rest of capsule, tapering gradually into seta; operculum small, conical, pointed, shining; annulus present; walls of capsule thick; exothelial cells thick-walled, tending to be irregularly elongated rectangular, shortened toward mouth of capsule; stomata in neck; peristome inserted well below mouth of capsule, outer teeth with a prominent and deeply colored fundus, otherwise brownish-yellow, much lighter than the capsule wall, rather slender, narrowly bordered, densely papillose, dorsal divisural lines fine and distinct but not far projecting, longitudinal line zig-zag in lower part of tooth, more nearly straight above, dorsal plates 2 or 3 times as wide as high, lamellae not very numerous (20 or more), rather close and prominent in lower part of tooth; inner peristome nearly as dark as outer, papillose, basal membrane fairly high, segments slender and narrowly fenestrated, cilia slightly appendiculate; spores dark brownish-yellow, roughened,  $15-18 \mu$ , ripening in summer.

ILLUSTRATIONS:—Bry. Eur. *pl. 381*; Braithw. Brit. Moss Fl. **2**: *pl. 73C*; *Pl. 96A*.

EXSICCATI:—Holz. 582 is from Europe.

On wet rocks and by brooks, from the northern United States (Maine, New Hampshire, northern Michigan, Idaho) northward into British America; south of its range other species have sometimes been confused with it; also in Europe and Asia.

**30. BRYUM GEMMIPARUM** DeNot. Comment. Soc. Crittog. Ital. **2**: **211**. 1865.

*Bryum alpinum*  $\beta$  *mediterraneum* DeNot. Syllab. **129**. 1838.

*Bryum muticum* Lange, Bot. Tidskr. **2**: **243**. 1868.

*Bryum flexuosum* Aust. Bot. Gaz. **4**: **152**. 1879.

*Bryum percurrentinerve* Kindb. in Mac. Cat. Can. Pl. **6**: **126**. 1892.

*Bryum capitellatum* C. M. & Kindb. in Mac. Cat. Can. Pl. **6**: **127**. 1892.

*Bryum Williamsi* Philib. Rev. Bryol. **28**: **32**. 1901.

Closely related to *B. Muehlenbeckii*, differs in lack of red color, being regularly of light yellowish-green, leaves broad, ovate to oval-oblong, apex rounded to obtuse to subacute, costa strong, ceasing at or slightly below apex, leaf margin reflexed only toward base, leaf not notably bordered; cells of leaf blade with thicker or thinner non-pitted walls, but with thickened corners, rather broad,  $40 \times 15 \mu$  or slightly larger; gemmae rarely occurring in upper leaf-axils. Plants dioicous and rarely fruiting; capsule fairly large, up to 4 mm. long, brown or yellow-brown, neck prominent and considerably contracted in drying; peristome inserted close to mouth of capsule, outer teeth yellow, long and broad, lamellae numerous, close and far projecting, rarely connected by cross-walls or themselves joining at an angle; inner peristome paler, with a high basal membrane ( $\frac{1}{2}$  or more), short narrow segments, keeled and narrowly fenestrated, cilia delicate and not strongly appendiculate; spores dark yellow, papillose, about  $20 \mu$ , ripening in summer. Type locality, Southern Europe (Sardinia).

ILLUSTRATIONS:—Bull. N. Y. Bot. Gard. 2: *pl. 38*; Roth, Eur. Laubm. 2: *pl. 15, f. 1; Pl. 94A*.

This species has not generally been recognized as occurring in America (its presence was suspected by Best), but our southern specimens, like those of Europe, do not fit well into *B. Muellenebeckii* or *B. alpinum*, though I find them agreeing with the European *B. gemmiparum*. Among other things they are extremely calciphile, while the other species of the group occur on acid rocks, as noted by Limprecht. All the species of the group are so closely related that some of the distinctions may ultimately break down, but I have not been able to demonstrate that they are not valid. Specimens seen are from New Jersey, Pennsylvania, Oklahoma, Arizona, southern California and northward to British Columbia, Montana and Newfoundland. *B. Mildeanum* Jur. is a European species generally assigned to the above group, which I have not found represented in American material.

31. *BRYUM BICOLOR* Dicks. Crypt. Fasc. 4: 16. 1801.

*Bryum atropurpureum* of many authors, not Wahlenb. in Web. & Mohr, Ind. Mus. Crypt. 1803.

*Mnium bicolor* Pal. de Beauv. Prodr. 74. 1805.

*Bryum versicolor* A. Braun in Br. & Sch. Bry. Eur. fasc. 6/9: 75. 1839.

*Bryum californicum* Sulliv. Pacific R.R. Rep. 4: 188, *pl. 6*. 1857.

*Bryum occidentale* Sulliv. Pacific R.R. Rep. 4: 188, *pl. 7*. 1857.

*Bryum Mohrii* Lesq. Bull. Torr. Bot. Cl. 5: 50. 1874.

*Argyrobryum bicolor* Kindb. Bih. K. Sv. Vet.-Akad. Handl. 7, No. 9: 79. 1883.

*Bryum microerythrocarpum* C. M. & Kindb. in Mac. Cat. Can. Pl. 6: 124. 1892.

*Bryum microglobum* C. M. & Kindb. in Mac. l. c. 6: 129. 1892.

*Bryum campitoneuron* Card. & Thér. in herb.

Plants small, gregarious, sometimes growing with other mosses, rarely exceeding 0.5 cm. in height, dark to brownish green, radicles confined to basal part; stems erect, reddish, branching from basal part. Leaves numerous and close, imbricate and not distorted when dry, slightly more erect-spreading when moist, the lower small and inconspicuous, the comal larger and in a close rosette, ovate, acuminate, concave, not decurrent, margin more or less reflexed, entire; costa rather strong, yellowish, percurrent or in upper leaves excurrent, rarely in a long toothed point; cells of leaf blade with thick non-pitted walls, irregularly rhomboidal, up to  $35 \times 15 \mu$ , narrower toward margin, but without forming a definite border, short rectangular toward base. Inflorescence dioicous, plants generally fruiting; antheridia terminal in a bud-like head, numerous, paraphyses yellowish, slightly longer than the antheridia. Seta slender, flexuose, purple, 1 cm. high, sometimes slightly higher; capsule pendulous, generally dark red when mature, varying considerably in size and shape, from oval to oblong to narrowly obovate, with neck usually rounded and short, sometimes longer and contracted when dry so that it appears to be tapering into seta, 1.5 to 3 mm. long, neck never as long as rest of capsule; operculum conical or convex, pointed, red, shining; annulus present; capsule-wall thick, exothelial cells thick-walled, somewhat irregular in shape, not elongated, the 4 or 5 rows next to capsule-mouth somewhat flattened, those of neck much smaller and thinner-walled; stomata in neck; peristome inserted close to mouth of capsule, outer teeth strong, brown-yellow, strongly incurved when dry, narrowing abruptly above into very slender apex, distinctly bordered with irregular margin, densely papillose, dorsal divisural lines distinct but not far projecting, longitudinal line zig-zag, dorsal plates 3 or more times as wide as high, ventral lamellae numerous and close, distinct but not far projecting; inner peristome lighter yellow, papillose, basal membrane high, segments rather narrow, narrowly fenestrated; cilia appendiculate or nodose; spores small,  $8-12 \mu$ , yellow, slightly roughened, ripening in May or June. Type locality, Europe.

ILLUSTRATIONS:—Schwaegr. Suppl. 1<sup>2</sup>: *pl. 70*; Bry. Eur. *pl. 378, 379*; Braithw. Brit. Moss Fl. 2: *pl. 72DE*. Pac. R.R. Rep. 4: *pl. 6, 7; Pl. 95*.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. 194, (Ed. 2) 291, 292; Holz. Musc. Acro. Bor. Am. 318, 370, 372, 455.

Mostly on moist sandy ground. South to Florida, Alabama, Louisiana, Missouri, and California; northward to southern Canada; also in Europe, western Asia and northern Africa. Closely related species extending through Mexico and into various parts of the southern hemisphere may prove to be identical. American specimens which have been or might be referred to the European *B. erythrocarpum* Brid. (1807) are merely *B. bicolor* with some or all the capsules elongated, accordingly with longer neck, which then contracts with wrinkles and folds in drying, a condition sometimes paralleled for example by capsules of *B. argenteum*. In fact I am inclined to doubt that the European *B. erythrocarpum* is itself specifically distinct from *B. bicolor*. Though the original *B. occidentale* Sulliv. seems to have been *B. bicolor*, it has since been confused especially with *B. capillare*, also with other species.

## 32. BRYUM BLINDII Br. &amp; Sch. Bry. Eur. fasc. 32: 11. 1846.

*Bryum Kiaerii* Lindb. Musc. Scand. 41. 1879.

*Argyrobryum Blindii* Kindb. Bih. K. Sv. Vet.-Akad. Handl. 7, No. 9: 78. 1883.

Plants gregarious or loosely tufted, sometimes growing with other mosses, low, hardly exceeding 3 mm., brownish green with a whitish tint in the younger shoots; stems somewhat erect, red, branching from basal part; leaves close, arranged rosette-like on fertile branches, imbricate on more elongated sterile ones, broadly ovate, obtuse, entire, margin plane except in inner comal leaves, where it is slightly revolute; costa strong, brownish, generally ending just below apex; cells of leaf blade with moderately thick non-pitted walls, narrowly rhomboidal, up to  $60 \times 10 \mu$ , gradually narrower toward margin, but not forming a distinct border, not much altered in base, save that they are thin-walled in alar region.

Inflorescence dioicous, plants generally fruiting in collected specimens. Seta rather strong for size of plants, often geniculate at base, erect, flexuose, dark purplish red, up to 2 cm. high; capsule inclined to pendulous, up to 2.5 mm. long, oval with short neck, dark red; operculum small compared with thickness of capsule, nearly hemispherical with small projecting point, dark red, shining, very persistent in place; annulus present; exothecial cells with moderately thick walls, irregular, some elongated, others not, not much changed toward mouth of capsule, the last 2 rows smaller and flattened, those of neck short, irregular in shape; stomata numerous in neck; peristome inserted close to mouth of capsule, outer teeth brownish-yellow, rather long and strong for size of capsule, very densely papillose, dorsal divisural lines not very distinct or far projecting, longitudinal line zig-zag, lower dorsal plates 3 or more times as wide as high, ventral lamellae numerous and close, rather prominent; inner peristome rather thick, dark yellow, strongly roughened with irregularly shaped papillae, basal membrane high, segments narrow with rather narrow slits, cilia well-developed, nodulose or appendiculate; spores yellow, around  $15 \mu$ , slightly roughened, maturing in July or August. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 383; Roth, Eur. Laubm. 2: pl. 15, f. 14; 96B.

EXSICCATE:—Holz. Musc. Acro. Bor. Am. et Eur. 581 is European.

On sandy ground. Only 2 collections from North America have been seen: one collected by Macoun at Hector in the Canadian Rockies in 1890 and correctly named by Kindberg, the other likewise from Canada (Port Arthur, Ontario, 1931) was sent me by Cheney; found otherwise in Europe, in the Alps, Latvia and Scandinavia, in the vicinity of glaciers, etc. Its inclusion with *B. argenteum*, whether as a genus *Argyrobryum* (Kindberg) or as a subsection (Engler-Prantl), rests upon a misunderstanding of its relationships, which are rather with *B. bicolor*, as I note Amann has also suggested under Bauer 1630.

33. BRYUM CORONATUM Schwaegr. Suppl. 1<sup>2</sup>: 103. pl. 71. 1816.

Many synonyms applied to exotic specimens.

Plants rather closely tufted, low, rarely up to 1.5 cm. or more, green, in lower part matted with brown radicles; stem more or less erect, slender, flexuose, branching from basal part, green, becoming reddish or brownish in lower portions; leaves numerous, closer in upper portion of stem, more distant below, erect-spreading when moist, not greatly distorted when dry, the comal ones larger than those below, slightly decurrent, narrowly ovate, sharply acuminate, margin revolute for some  $\frac{2}{3}$  the length of leaf, entire; costa slender, green, percurrent to slightly or long excurrent; cells of leaf blade lax with thin, non-pitted walls, narrowly hexagonal-rhomboidal, up to  $50 \times 15 \mu$ , narrower toward margin, but without a clearly defined border, broad and short and approaching the rectangular in basal part. Inflorescence dioicous, male plants often growing intimately intermixed with others and abundant capsules produced; antheridia in a terminal bud-like head. Seta slender, flexuose, red, lighter in upper part, up to 2 cm. high; capsule pendulous, dark red when mature, cylindrical with a short rounded neck, which on drying often appears broader than the rest of capsule, operculate about 2.5 mm. long; operculum convex-conical, pointed, dark red when mature; annulus present; exothecial cells thick-walled, irregular in shape, some of them slightly elongated, gradually shortened in 4 or 5 rows at mouth of capsule, those of neck also shorter and with thinner walls; stomata numerous in neck; peristome inserted close to mouth of capsule, outer teeth dark brown-yellow, narrowing abruptly above into slender lighter colored apex, papillose, not distinctly bordered but with irregular margin, dorsal divisural lines not very distinct or far projecting, longitudinal line zig-zag, dorsal plates 3 or more times as wide as high, ventral lamellae rather numerous and close, not far projecting; inner peristome lighter yellow, papillose, basal membrane high, more than half total height, segments not

very broad, keeled and fenestrate; cilia 2 or 3, prominently appendiculate; spores small, around  $10 \mu$ , yellow, nearly smooth, maturing in Florida in March or April. Type locality, Guiana.

ILLUSTRATIONS:—Schwaegr. l. c.; Bryol. Jav. pl. 118; pl. 924.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 117; Grout, Musc. Perf. 72.

On ground, rocks and walls throughout the tropics, reaching our range in Florida, where it is apparently not uncommon.

34. BRYUM ARGENTEUM L. Sp. Pl. 1120. 1753.

*Hypnum argenteum* Schrank, Baier. Fl. 469. 1789.

*Mnium argenteum* Hoffm. Deutsch. Fl. 2: 51. 1796.

*Mnium lanatum* Pal. de Beauv. Prod. 75. 1805.

*Bryum lanatum* Brid. Spec. Musc. 3: 20. 1817.

*Argyrobryum argenteum* Kindb. Bih. K. Sv. Vet.-Akad. Handl. 7, No. 9: 78. 1883.

*Plagiobryum argenteoides* Williams, Bull. N. Y. Bot. Gard. 2, No. 6: 129. 1901.

*Zieria argenteoides* Kindb. in Mac. Cat. Can. Pl. 7: 255. 1902.

and many synonyms applied to specimens from various parts of the world.

Plants often densely tufted, sometimes more loosely spreading or growing with other mosses, generally more or less white or silvery, not matted with radicles; stems tending to be erect, but often somewhat flexuose, slender, red, round in section with central strand, branching, frequently with short compact branches which break off and serve for vegetative reproduction; leaves numerous and close, imbricate both dry and moist, small, not decurrent, extremely concave, broadly ovate, generally acuminate or cuspidate in a slender sharp point, entire, margin plane or slightly reflexed in basal part; costa slender, reddish at base, becoming green above, ceasing below apex;\* cells of leaf blade thin-walled in upper part of leaf, which part with its lack of chlorophyll gives the plants their silvery white appearance, the chlorophyll-bearing cells below thicker-walled and especially with thickened corners, hardly pitted, somewhat narrow, up to  $50 \times 15 \mu$ , broader and short rectangular or nearly square and reddish pigmented in basal part. Inflorescence dioicous, male plants sometimes occurring with others and fruit produced abundantly, but sterile tufts are common; antheridia in a terminal bud-like head, paraphyses filiform, yellow, some of them longer than antheridia. Seta slender, erect, flexuose, red, generally 1 cm. high, sometimes more; capsule pendulous, small, generally not more than 1.5 mm. long, oblong with short rounded neck, which may shrink in drying so that it seems to taper into seta, sometimes more elongated, often red, but sometimes lighter brownish in color; operculum relatively large, convex or low-conical, pointed, shining; annulus present; exothelial cells very thick-walled, irregularly shaped, elongated, often 2 or 3 times as long as wide, the outer cuticle strongly verruculose, sharply differentiated in about 8 rows at mouth of capsule, being here broader than high and having a smooth outer cuticle, the last 3 or 4 rows darker pigmented, those of neck also shortened, with numerous stomata; peristome inserted close below mouth of capsule, outer teeth brownish yellow, orange at base, gradually tapering to a slender more hyaline tip, narrowly bordered, very finely papillose, dorsal divisural lines distinct, longitudinal line zig-zag, dorsal plates toward base 2 or 3 times as broad as high, ventral lamellae fairly numerous and close, distinct and rather far projecting; inner peristome lighter in color and generally shorter than outer, finely papillose, basal membrane rather low, hardly half the full height, segments rather broad, fenestrate; cilia appendiculate; spores yellow, varying from 14 to 18  $\mu$ , nearly smooth, ripening in winter or early spring. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 384; Braithwaite, Brit. Moss Fl. 2: pl. 72C; M. H. M. f. 115.

EXSICCATI:—Drumm. Musc. Am. 251; Aust. Musc. Appal. 198; Sull. Musc. Allegh. 102; Sull. & Lesq. 193, (Ed. 2) 290; Holz. Musc. Acro. Bor. Am. 115, 290, 526; Ren. & Card. Musc. Am. Sept. Exs. 305; Grout, Musc. Perf. 166, 247.

On ground, rocks, bricks, etc. throughout our range, generally distributed as a weed throughout the world. Not closely related to any of our other species.

35. BRYUM CAPILLARE L. Sp. Pl. 1586 (in part). 1753.

*Hypnum capillare* Weis, Pl. Crypt. Fl. Gott. 205. 1770.

*Mnium capillare* L. Syst. Veg. (Ed. 14) 947. 1784.

*Bryum elegans* Nees in Brid. Bry. Univ. 1: 849. 1826.

\* Except in var. *lanatum* (P. B.) Bry. Eur. (A. J. G.)

*Bryum torquescens* Br. & Sch. Bry. Eur. fasc. 6/9: 49. 1839.  
*Bryum obconicum* Hornsch. in Br. & Sch. l. c. 59. 1839.  
*Bryum oreganum* Sulliv. Musc. Wilkes Explor. Exped. 17: 10, pl. 7. 1859.  
*Bryum Baueri* Hpe. Linnaea 30: 457. 1860.  
*Bryum Sawyeri* Ren. & Card. Rev. Bryol. 15: 71. 1888.  
*Mielichhoferia cuspidifera* Kindb. in Mac. Cat. Can. Pl. 6: 110. 1892.  
*Bryum sanguilentum* Ren. & Card. Rev. Bryol. 20: 31. 1893.  
*Bryum speirophyllum* Kindb. Bull. Soc. Bot. Ital. 1896: 17.  
*Bryum squarrosum* Kindb. Hedwigia 35: 66. 1896.  
*Bryum streptophyllum* Kindb. Eur. & N. Am. Bryin. 359. 1897.  
*Bryum trichophorum* Kindb. l. c. 359. 1897.  
*Bryum gemmascens* Kindb. l. c. 360. 1897.  
*Bryum tomentosum* Kindb. l. c. 361. 1897.  
*Bryum heteroneuron* C. M. & Kindb. l. c. 361. 1897.  
*Bryum subdrepunculatum* Card. & Thér. Bot. Gaz. 37: 374. 1904.  
*Bryum Baileyi* Holz. Bryol. 8: 54. 1905.  
*Bryum Fosteri* Holz. Bryol. 8: 80. 1905.  
*Bryum floridanum* Ren. & Card. in herb.  
 and apparently many other synonyms from various parts of the world.

Plants generally closely tufted, mostly low, 1 cm. or less, sometimes higher, normally green, sometimes brownish, especially in older parts, with a considerable growth of brown radicles; stems tending to be erect, flexuose, brown or red, pentagonal in section with central strand; leaves small and distant in lower part of stem, progressively larger and closer toward apical region where they form more or less of a rosette, erect-spreading when moist, variously contorted or twisted when dry, somewhat decurrent, from a narrow base normally broadly obovate, but with considerable variation in shape and size, normally cuspidate at apex, margin tending to be reflexed in lower part, sometimes serrulate toward apex; costa frequently brownish, strong at base, tapering above and generally ending below apex of leaf, sometimes excurrent; cells of leaf blade normally with thin non-pitted walls, broadly hexagonal, up to  $70 \times 35 \mu$ , more nearly rectangular in base, generally with a clearly marked border of 2 or 3 rows of long narrow thick-walled cells only 1 layer in thickness which extend into and form the cuspidate leaf-point, sometimes the border is less distinct or lacking. Dark yellow filiform jointed roughened propagula often clustered in leaf-axils. Normally dioicous, sometimes synoicous, often without capsules, but sometimes fruiting abundantly; antheridia (except in synoicous form) in a terminal head, numerous with numerous paraphyses, the inner perigonal leaves, antheridia and paraphyses all pigmented yellow, paraphyses slightly if at all longer than antheridia. Seta of varying length, up to 3 cm., fairly strong, erect, flexuose, reddish brown; capsule horizontal or inclined, clavate, generally curved at least in neck portion, light brown, sometimes dark red-brown, up to 4 mm. long, rarely longer, sometimes quite small, neck tapering gradually to seta, generally not as long as rest of capsule; operculum large, darker than capsule and shining, low conical or convex with blunt tip, easily deciduous; annulus present; exothecial cells thick-walled, irregular in size and shape, some of them elongated, markedly smaller, flattened and dark pigmented in about 4 rows at mouth of capsule; stomata in neck, slightly bulging above surface; peristome inserted below mouth of capsule, outer teeth slender and well separated at base, yellow with slender hyaline tips, prominently bordered, densely papillose, dorsal divisural lines not very distinct or prominent, longitudinal line zig-zag, dorsal plates only about twice as wide as high, ventral lamellae fairly close and numerous, not far projecting; inner peristome lighter yellow, papillose, basal membrane high, segments rather broad, fenestrated; cilia appendiculate; spores dark yellow, roughened,  $10 \mu$  or more, ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 367, 368, 369; Braithw. Brit. Moss Fl. 2: pl. 71C, 74D; M. H. M. pl. 48. EXSICCATI:—Aust. Musc. Appal. 199, 513; Sull. & Lesq. Musc. Bor. Am. 185, 187b, 188, (Ed. 2) 280, 283, 284, 285; Holz. Musc. Acro. Bor. Am. 45, 118, 170, 221, 258, 291, 320, 371, 427; R. & C. Musc. Am. Sept. 61, 223; Grout, Musci Perf. 79, 305.

On moist ground, especially humus, also on bark of trees, decayed wood, rocks, etc. Occurs throughout our range and is widely distributed over pretty much the whole world, where it has accumulated a great number of synonyms. It is naturally variable in many of its characters. The synoicous form, called *B. torquescens*, differs in no other feature than its inflorescence and hardly deserves specific distinction.

## 36. BRYUM CANARIENSE Brid. Sp. Musc. 3: 29. 1817.

*Bryum provinciale* Philib. in Schimp. Syn. (Ed. 2) 432. 1876.

*Bryum Hendersoni* Ren. & Card. Bot. Gaz. 15: 44, pl. 7C. 1890.

and apparently further synonyms for plants from the southern hemisphere.

Plants loosely or closely tufted, sometimes growing among other mosses, rarely exceeding 2 cm. high, generally lower, green, older parts brownish, sometimes densely matted with brown radicles; stems strong, more or less erect, flexuose, brown, pentagonal in section with central strand, often proliferating from center of leaf-tuft or innovating from below it; leaves few, small and scattered except in terminal rosette where they are relatively large and compactly tufted, the comal leaves spreading when moist, imbricate and not much contorted when dry, obovate, not acuminate, margin revolute in lower two-thirds, serrate or serrulate toward apex; costa strong in base, tapering gradually to apex where it is generally excurrent in a rather long, reflexed, sometimes toothed point; cells of leaf blade with rather thick and pitted walls, rhomboidal-hexagonal, up to  $50 \times 20 \mu$ , rectangular in base, toward margin narrower, but not forming a distinct border. Inflorescence normally dioicus, European specimens sometimes autoicus and said to be even synoicous, frequently fruiting; antheridia not always easily found, those seen in American plants were few in a small terminal head, reddish, with inconspicuous paraphyses. Seta strong, erect, flexuose, sometimes geniculate at base, reddish brown, 2 cm. or more in length; capsule inclined to pendulous, subcylindrical, brown or red-brown, generally curved, up to 5 mm. long or more, neck shorter than rest of capsule; operculum large, hemispherical or low conical with blunt point, sometimes darker than capsule and shining; annulus present, large; exothecial cells thick-walled, narrow and much elongated, 3 times as long as wide or more, gradually shorter in some 6 or 8 rows at mouth of capsule, the latter slightly darker pigmented and shining like the operculum, those of neck also somewhat shorter and irregular in shape, with numerous large stomata; peristome inserted slightly below mouth of capsule, outer teeth yellow, orange at insertion, hyaline in slender tip, rather strong, well separated to base, bordered, finely papillose, dorsal divisural lines rather indistinct, except toward tip of tooth, longitudinal line irregular but not markedly zig-zag, dorsal plates 4 or more times as wide as high in basal part of tooth, ventral lamellae prominent, very numerous and close; inner peristome light yellow, slightly roughened, basal membrane moderately high, segments broad and broadly fenestrated, cilia generally in 2's, not very strong and only nodulose or slightly appendiculate; spores greenish-yellow,  $10-15 \mu$  in same capsule, very slightly roughened, maturing in spring. Type locality, Teneriffe, Canary Islands, leg. Rudley.

ILLUSTRATIONS:—*Bry. Eur.* pl. 366 (as *B. Billarderii*); *Braithw. Brit. Moss Fl.* 2: pl. 75B; Pl. 95.

On ground in Pacific coastal region from Vancouver Island to northern California; also in southern and western Europe, Africa including South Africa and the Atlantic Islands; probably also elsewhere in the southern hemisphere (I doubt for example that *B. Jaffueli* Thér. from Chile is distinct). The inclusion of Florida within its range by Lesq. & James rests upon wrong identification. The current separation of *B. provinciale* from *B. canariense* by reason of inflorescence, which is admittedly variable, seems to me unjustified, as noted also by Dismier. According to Dixon the type of *B. Billarderii* Schwaege. (1816) is quite distinct from this species and more closely related to the following one, which, however, is in contradiction to the evidence of both the original description and illustration.

## 37. BRYUM TRUNCORUM Brid. Sp. Musc. 3: 50. 1817.

*Bryum andicola* Hook. in Kunth, Syn. Pl. Aequinoct. 1: 58. 1822.

With an apparently extensive synonymy from tropical and south temperate regions, especially America.

Commonly compared with the last species. Stems generally short with leaves mostly densely crowded in a terminal rosette, generally more or less twisted when dry, more spreading when moist, obovate to obovate-spatulate, short acuminate, denticulate in apical part, with distinct border of at least 2 rows of narrow cells, costa strong and short excurrent. Inflorescence normally dioicus and only rarely fruiting, not found fruiting within our range; antheridia numerous in a terminal rosette, with numerous paraphyses, both green; rarely 2 setae from the same perichaetium; capsule rather brown or yellow-brown than red-brown. Otherwise as in the last species. Type locality, the island Réunion (Bourbon) in the Indian Ocean.

ILLUSTRATION:—Pl. 91A.

EXSICCATI:—Bartram, Mosses of Southern Arizona 171 (as *B. comatum* Besch.).

On ground, widely distributed through South and Central America and Mexico and the West Indies; also generally through the southern hemisphere; reaching our area in Arizona, where it was collected in

several localities by Bartram; also found in Texas by E. J. Palmer, 1928 and by Orcutt. The name *B. Billarderii* Schwaegr. would have a year priority over *B. truncorum*, but Dixon who had examined the type specimen regarded it as (somewhat doubtfully) distinct; it has generally been associated rather with *B. canariense*. That the American plant, first named *B. andicola* Hook. might be identical with the Old World species *B. truncorum* Brid. has been suggested already by Dixon. Both show similar considerable variations of size and other quantitative characters. *B. Donianum* Grev. was given American representation by Kindberg, but evidently on the basis of misidentification.

38. *BRYUM SANDBERGII* Holz. Contrib. U. S. Nat. Herb. 3: 271. 1895.

*Mnium Roellii* Broth. Bot. Centralbl. 44: 420. 1890.

*Bryum lucidum* E. G. Brit. Bull. Torrey Bot. Cl. 18: 53. 1891; not T. P. James, Journ. Acad. Nat. Sc. Philadelphia, 2nd Series, 3: 202. 1856.

*Mnium lucidum* Broth. Hedwigia 32: 293. 1893.

*Mnium simplex* Kindb. Rev. Bryol. 23: 22. 1896.

*Roellia simplex* Kindb. l. c. 1896.

*Roellia lucida* Kindb. l. c. 1896.

Plants loosely tufted, 2 cm. high, usually light green, with brown radicles mostly in basal part; stems strong, erect, flexuose, red, not branching, pentagonal in section with central strand; leaves small, distant and scale-like on lower part of stem, very large and closely arranged in a rosette at summit, spreading when moist, loosely imbricate and not much distorted when dry, broadly ovate to obovate, short acuminate, plane at margin or slightly reflexed in lower part, slightly decurrent, distinctly and often strongly serrate in upper part or nearly to base; costa slender, yellowish green, ceasing just below apex, in section without a stereid-band, a few cells dorsal to the center slightly smaller than the others, thicker-walled and brownish pigmented occupying its place; cells of leaf blade large, with thin, non-pitted walls, irregularly elongated hexagonal, up to  $150 \times 50 \mu$ , more nearly rectangular toward base, narrower toward margin, with definite border of 2 rows of narrow cells, those of outer row in upper part of leaf with projecting upper ends, giving the leaf a serrate margin. Inflorescence dioicous, but not infrequently fruiting; antheridia very numerous in a disk-like head, yellowish, paraphyses relatively not very numerous or conspicuous, filiform, hyaline, generally shorter than antheridia. Seta single, stout, erect, straw-color above, more reddish below, up to 4 or more cm. high; capsule horizontal or inclined, nearly cylindrical, sometimes slightly curved, light yellow-brown, up to 7 mm. long, the neck short, only 2 mm.; operculum rather small, low-conical with a blunt more reddish point, not shining, quickly shed on maturing of capsule; annulus present; exothelial cells thick-walled, elongated rectangular, gradually shortened in some 5 rows at mouth of capsule, the last ones darker pigmented, stomata in neck, small, phaneropore; peristome inserted close to mouth of capsule, outer teeth strong, yellow, tapering gradually, very finely papillose and very narrowly bordered, dorsal divisural lines indistinct and not far projecting, the ventral lamellae numerous, close and far projecting. Inner peristome hyaline, minutely roughened, basal membrane high, segments broad, abruptly contracting to a narrow toothed point, widely gaping; cilia sometimes as many as 4, rather short and weak, slightly nodulose; spores dark yellow, roughened, about  $15 \mu$ , ripening in summer. Type locality, Hope, Kootenai Co., Idaho, leg. J. H. Sandberg, 1892.

ILLUSTRATIONS:—Bull. Torr. Club 18: pl. 114, f. 1-10; Pl. 97A.

EXSICCATA:—Holz, Musc. Acro. Bor. Am. 296; Verdoorn, Musc. Select. et Crit. 236.

On ground in Pacific coastal region from British Columbia to northern California, inland to Montana and Wyoming. Not uncommon in this region and a very distinct plant, so that it is remarkable it should have remained unnoticed until nearly 1890, when it was collected in a number of localities and recognized independently by several bryologists. It appears in recent works as a separate monotypic genus *Roellia*, generally placed in the Mniacaceae, where it clearly doesn't belong. If one wishes to retain the genus in either family, priority would demand the combination *Roellia Roellii* (Broth.). In Bryum this specific name is not available, as there exists a prior name *Bryum Roellii* Philib. published earlier in 1890. Mrs. Britton's *Bryum lucidum* is also not to be used, as she herself realized later according to her herbarium-notes, as T. P. James had published a *Bryum lucidum*, which according to Lange and C. Jensen was a form of *Pohlia cruda*. The name of Holzinger then antedates by a year that of Kindberg (*simplex*) and should then be retained.

## 8. RHODOBRYUM (Schimp.) Limpr. Laubm. 2: 444. 1892.

*Bryum* subg. *Rhodobryum* Schimp. Syn. 381. 1860.

Robust plants in loose tufts, with subterranean rhizomatous growths, from which rise erect shoots with terminal rosettes of leaves, sometimes innovating from below the tip or proliferating through the leaf-rosette; lower leaves distant, scale-like, those of terminal rosette large and spreading, generally bordered and toothed; costa strong and in our species showing a small crescent-shaped group of stereid-cells just dorsal to the center; cells of leaf blade broad and large. Inflorescence generally dioicous. Antheridia numerous in a large disk-shaped terminal head. Sporogonia tending to be aggregated, 1-3, sometimes more from the same perichaetium; capsule on a long seta, horizontal to pendulous, somewhat cylindrical with short neck; annulus present; peristome complete, cilia nodulose to appendiculate. Type species, *R. roseum* (Weis) Limpr.

A genus not very clearly separated from the larger *Bryum*-species nor entirely homogeneous within itself, distributed in relatively few species over a large part of the world; represented in our area by a single species, which is common at least to Europe and Asia.

## ✓ RHODOBRYUM ROSEUM (Weis) Limpr. Laubm. 2: 445. 1892.

*Mnium roseum* Weis, Pl. Crypt. Fl. Gotting. 157. 1770.

*Bryum roseum* Schreb. Spic. Fl. Lips. 84. 1771.

*Mnium proliferum* (L.) Leyss. Flor. Halens. 272. 1783.

*Hypnum roseum* Schrank, Baier. Fl. 2: 471. 1789.

*Bryum proliferum* Sibth. Flor. Oxon. 292. 1794.

*Bryum ontariense* Kindb. Bull. Torr. Bot. Cl. 16: 96. 1889.

*Rhodobryum ontariense* Par. Ind. Bryol. 1119. 1898.

Plants loosely tufted or gregarious, often growing with other mosses, up to 3 cm. high, dark green, with dense growth of purplish-brown radicles; stem strong, often extending stolon-like for a considerable distance within the substratum, then rising more or less erect, flexuose, with small scale-like appressed leaves, the comal ones very large in a dense rosette, spreading when moist, variously distorted when dry, obovate-spatulate, acuminate, with margin revolute in lower  $\frac{2}{3}$  or more, plane above, sharply dentate in upper portion; costa green, strong in basal part, rapidly tapering, ceasing slightly below apex or percurrent to excurrent in the sharp point, in section biconvex with a small dorsal crescent-shaped stereid-group; cells of leaf blade large with rather thick, strongly pitted walls, rhomboidal-hexagonal, up to  $100 \times 40 \mu$ , becoming nearly rectangular in whole basal part, bordered by at least 1 or 2 rows of narrow cells. Inflorescence dioicous, but not infrequently fruiting; antheridia very numerous in a large terminal disk-like head, yellowish, paraphyses very numerous, filiform, longer than antheridia, greenish with chlorophyll. Seta sometimes single, commonly aggregated, sometimes up to 6 from the same perichaetium, erect, straight, up to 5 cm. high, reddish brown; capsule pendulous or nearly so, cylindrical, slightly curved, contracting abruptly into a very short neck, altogether about 7 mm. long, brown; operculum rather large, convex-conical with a prominent blunt tip; annulus present; exothelial cells thick-walled with thickened corners, making them roughly elliptical, but varying considerably in size and shape, slightly elongated, gradually shortened and darker pigmented in 4 or 5 rows at mouth of capsule, stomata confined to neck, phaneropore; peristome inserted close to mouth of capsule, outer teeth brown, strong, incurved when dry, with a long slender hyaline tip, densely papillose, narrowly bordered, dorsal divisural lines inconspicuous, longitudinal line zig-zag, ventral lamellae numerous and close, those of upper part projecting farther than those below; inner peristome yellow, densely papillose, basal membrane high, segments not very broad, broadly fenate, cilia weak, nodulose to appendiculate; spores brownish yellow, varying from 20 to  $25 \mu$  in same capsule, roughened, maturing in late autumn or winter. Type locality, Europe.

ILLUSTRATIONS:—*Bry. Eur.* pl. 365; *Braithw. Brit. Moss-Fl.* 2: pl. 75 C; *M. H. M. f.* 116.

EXSICCATI:—Drumm, Musc. Am. 255; Aust. Musc. Appal. 203; Sull. Musc. Allegh. 96; Sull. & Lesq. Musc. Bor. Am. 187, (Ed. 2) 282; Holz. Musc. Acro. Bor. Am. 146; Ren. & Card. Musc. Am. Sept. 181, 181b.

On ground, rocks, logs and bark of trees in moist shady places, widely distributed through our territory where conditions are favorable, also in Europe and Asia, not reaching the far north; probably represented by a number of synonyms in Central and South America and Africa. No good reason is apparent for separating the American from the Eurasian as *R. ontariense*.

It has been impossible to place with certainty the following species-names either from failure to see the type specimens because of war conditions or for other reasons. There is nothing in the descriptions or the localities in which the plants were found to lead one to think that they represent species additional to those enumerated above.

*Bryum alpiniforme* Kindb. in Mac. Cat. Can. Pl. 6: 271. 1892. From islands in Lake Nepigon, Ontario.

*Bryum gemmuligerum* Kindb. Eur. & N. Amer. Bryin. 368. 1897. Collected by J. Macoun in western Canada.

*Bryum pseudointermedium* Kindb. Rev. Bryol. 34: 29. 1907. Collected by N. L. T. Nelson at Vasa, Minnesota in 1903.

*Bryum brachylepis* Kindb. l. c. 1907. Same locality and collector as last, 1906.

*Bryum glaciale* Kindb. Rev. Bryol. 34: 91. 1907. Collected by J. M. Macoun at Skagit Summit, British Columbia in 1905.

*Bryum parvulum* Kindb. Rev. Bryol. 36: 43. 1909. Collected by J. Macoun at Gaspé in 1907; renamed *B. Macounii* Kindb. Rev. Bryol. 36: 100. 1909.

*Bryum coloradense* Kindb. Rev. Bryol. 36: 98. 1909. Collected by N. L. T. Nelson at Crested Butte, Colorado in 1908.

*Bryum synoicum* Arn. Ark. f. Bot. 15: No. 5: 59. 1917. Collected by F. R. Kjellman at Port Clarence, Alaska in 1879.

*Bryum longirostratum* Arn. Ark. f. Bot. 15: No. 5: 67. 1917. Same collector and locality as last.

As to natural grouping of the species left in the genus the most numerous constituent is that made up of the species *B. brachyneuron*, *B. pendulum*, *B. inclinatum*, *B. longisetum*, *B. archangelicum*, *B. lacustre*, *B. nitidulum*, *B. cirratum*, *B. cuspidatum*, *B. pallescens*, *B. caespiticium*, *B. bimum*, *B. crassirameum*. These form a closely related series, each species showing considerable variation, making good diagnostic characters hard to find and allowing on the other hand infinite scope for the activity of the irresponsible species-maker. It is much more probable that I have sought to define within this series too many rather than too few specific types. Of the species not certainly included in this series it is not impossible that the compact group represented by *B. miniatum*, *B. alpinum*, *B. Mühlenbeckii* and *B. gemmiparum* derives somehow from it. The same is perhaps true of the similarly compact group represented by *B. turbinatum*, *B. Weigeliae* and *B. tortifolium*, possibly also of the species *B. bicolor*, whose relationship to the other short-capsuled species *B. Bindii* and *B. coronatum* is not fully clear. The remaining species seem to be quite independent of this series, unless it be the poorly understood species *B. teres*, which may be an arctic form of one or more than one of the other species. It is quite conceivable that there may be some interrelationship among some of the species with lax leaf-areolation: *B. Wrightii*, *B. arcticum*, *B. purpurascens*, *B. cernuum*, *B. Biddlecomiae*, *B. pallens*, but each represents a quite distinct specific unit. *B. oeneum* on the other hand is clearly an arctic derivative, if not a mere form of *B. pallens*. *B. Marratii* is quite independent. So is *B. calophyllum*, with its derivative or form *B. acutum*. The same is apparently true of *B. argenteum*, which is hardly closely related to the other species with similar short capsules. That *B. capillare* is to be in any way connected with the lower organized species with lax leaf-areolation is not fully apparent; on the other hand it seems probable that the types *B. canariense* and *B. truncorum* are derivatives of it, though now well separated; the same may be true of the very distinct *B. Sandbergii*, which approaches *Rhodobryum*.

As to geographic distribution, the remarkable fact is the number and diversity of species flourishing in the far north, where many of them mature abundant fruit. Some of them are quite confined to such high latitudes, where their distribution is mostly circumpolar and collections are as yet too limited to permit definite conclusions as to restrictions of area, though it would appear that certain types which are not uncommon in northern Europe either do not reach North America or are confined to Greenland and its eastern or central arctic region or become uncommon in its western arctic area (Alaska), while on the other hand *B. brachyneuron* is at present known only from the Pribiloff and Aleutian Islands. Of species entering our range from the south *B. coronatum* is a common tropical species found in Florida and *B. truncorum* an essentially southern hemisphere species, reaching the United States through Mexico in the mountains of Arizona and Texas. The Pacific coastal region is marked by the occurrence of *B. canariense*, in Europe an Atlantic species, but occurring also in the southern hemisphere, by the endemic but not very distinct *B. crassirameum*, by the near endemic *B. miniatum*, found elsewhere only in the Faroe Islands, and the very distinct *B. Sandbergii*. *B. Biddlecomiae* appears to be endemic to the Rocky Mt. region. Other species generally have the common circumboreal distribution through the three northern continents, but a few reach also into the southern hemisphere: *B. argenteum* as a cosmopolitan, *B. capillare*, *B. bimum*, evidently *B. bicolor* and perhaps a few others, generally with a considerable accumulation of synonyms.

#### Family MNIACEAE

By A. LEROY ANDREWS, PH.D.

Conspicuous perennial plants, generally matted or tufted, sometimes associated with other bryophytes. Stems normally erect, often with a matted growth of brown papillose radicles, in section usually pentagonal with strong central strand; branching frequent and various. Leaves mostly large and conspicuous, of various shapes, more or less loosely arranged, the terminal ones often more closely aggregated in a rosette,

inner perichaetal leaves smaller; a border of elongated cells, one or more cells in thickness, is present in most species, also frequently single or double teeth; the costa is strong, but does not always reach the leaf-apex, in section it is somewhat complex, the guide-cells not always clearly defined, stereid-bands varying according to species, dorsal and ventral cells rather large. The leaf blade, except sometimes the border, consists of a single layer of parenchymatous cells, tending to be hexagonal, generally large and broad, their walls sometimes thickened or pitted, in one of our species mamillose.

Inflorescence terminal, dioicous or synoicous; the archegonia with filiform paraphyses, the antheridia generally with clavate ones. Capsules single or often several from the same perichaetium. Seta strong and elongated in our species, so that the capsules are always borne above and free from the foliage. Capsule in our species horizontal to pendulous, oblong to oval, with thin walls; neck short; stomata usually confined to neck, cryptopore; operculum convex to rostrate; calyptora cucullate, inconspicuous and fugacious; annulus normally present, removable; peristome double, segments of inner peristome in one genus coalesced; spores tending to be rather large.

#### KEY

Outer and inner peristomes of approximately equal length, inner peristome divided normally into segments and cilia.....  
 1. *Mnium*.  
 Outer peristome much shorter than inner, the inner peristome coalesced into a dome-like structure with round opening at summit and elongated lateral openings opposite teeth of outer peristome.....  
 2. *Cinclidium*.

#### 1. MNIUM L. Sp. Pl. 1109. 1753

*Polla* Adans. Fam. Pl. 2: 493. 1763.

*Astrophyllus* Neck. Elem. Bot. 3: 326. 1790.

*Trachycystis* Lindb. Not. Faun. Fl. Fenn. Förh. 9: 80. 1868.

*Leucolepis* Lindb. Not. Faun. Fl. Fenn. Förh. 9: 80. 1868.

Characters of the family. Teeth of outer peristome 16, of approximately same length as inner peristome, strong, not united at base, tending to be bordered, papillose; dorsal longitudinal line zig-zag, dorsal plates low; ventral lamellae numerous. Inner peristome yellow to reddish or brown, with high basal membrane which is in some species irregularly perforated; segments tapering to a mostly slender cuspidate apex, broadly fenestrate to gaping; cilia mostly in 3's, nodulose. Type species, *M. hornum*.

The current divisions of the *Mnium*-species into groups are not in all respects satisfactory. *M. Menziesii* occupies, as generally acknowledged, an independent place, though hardly sufficiently so to justify its separation as a distinct genus. *M. hymenophylloides* and *M. hymenophyllum* also seem not too closely related to other species of either *Mnium* or *Cinclidium*, but lack of adequate fruit makes it difficult to place them exactly. That *M. punctatum* and *M. cinctidivides* are well separated from the other species is indubitable, but that they should be joined to *Cinclidium*, as Loeske suggested, is not clear; they evidently stand closer to it than the other *Mniums* do. As to the customary separation of the species with single-toothed from those with double-toothed leaves, it is a convenient and perhaps natural one, but there is no very sharp line of demarkation between them. A division on the basis of the leaf-costa section has not proven entirely reliable, witness the wrong position of *M. stellare* in Limprecht and Engler and Prantl and the justified criticism of Loeske. It clearly belongs in the group with double-toothed leaves as Loeske maintained. That *M. flagellare* deserves a distinct place (genus according to Lindberg and more recently Kabisch) on the strength of its mamillose leaf-cells seems to me refuted by its otherwise clear relationship with the species with double-toothed leaves.

The geographic distribution of *Mnium* is in some respects peculiar, the genus belonging predominantly to the north temperate zone, rather few species reaching the high north, and *M. rostratum* (with synonyms) being almost the only one to extend through the tropics and into the southern hemisphere, though *M. affine* is also reported from southern South America. Furthermore many species have not attained a complete circling of the 3 northern continents, but are limited in one way or another. *M. flagellare* is eastern Asiatic and has not been found on the mainland of North America, but as yet only on islands belonging to Alaska. *M. Menziesii*, *M. venustum*, *M. insigne* and *M. arizonicum* are exclusively North American, all belonging to the Pacific states, except the last, which has a limited distribution in the Rocky Mts. region, where it vicariates for the closely related Eurasian *M. spinosum*. *M. insigne* is obviously a derivative of the widely distributed and greatly varying *M. affine*; *M. Menziesii* and *M. venustum* on the other hand are very distinct species without close relatives anywhere.

## KEY

1. Branching dendroid with numerous decurved branches.....  
Branching not dendroid.....

2. Leaf margin toothed.....  
Leaf margin entire.....

3. Leaf without a distinct border of elongated cells.....  
Leaf possessing a border of elongated cells.....

4. Leaf border weak, of one or two rows of cells, teeth nearly obsolete.....  
Border and teeth better developed.....

5. Leaf cells mamillose.....  
Leaf cells not mamillose.....

6. Leaf border with teeth mostly in pairs (not always or clearly so in *M. arizonicum*).....  
Leaf border with teeth always single.....

7. Leaves long and narrow, costa not reaching apex; operculum short, not rostrate.....  
Leaves broader, operculum rostrate.....

8. Inflorescence dioicus.....  
Inflorescence normally synoicous.....

9. Leaf cells small, rarely exceeding 20  $\mu$  in diameter, corners hardly thickened.....  
Leaf cells larger, generally exceeding 20  $\mu$  in one or both dimensions.....

10. Leaf cells irregularly rounded hexagonal with thickened corners and non-pitted walls.....  
Leaf cells elongated hexagonal, longitudinal axis running diagonally from costa to border, corners not thickened, walls pitted; teeth of leaf border often single.....

11. Leaf cells large, generally above 25  $\mu$  in diameter, somewhat quadrate with thickened corners and tending to be arranged in longitudinal rows.....  
Leaf cells generally less than 25  $\mu$  in diameter, tending to be hexagonal and with evenly thick walls, without thickened corners.....

12. Sterile shoots never stoloniform, capsule with differentiated brown neck.....  
Sterile stoloniform shoots normally present, neck of capsule not markedly differentiated.....

13. Leaf cells hexagonal with thin straight walls, corners not thickened.....  
Leaf cells showing a more rounded or elongated outline, with thickened corners.....

14. Inflorescence synoicous.....  
Inflorescence dioicus.....

15. Leaves acute to short-acuminate, toothed only on the margin of the upper half; leaf cells less than 25  $\mu$  in diameter; capsules single.....  
Leaves cuspidate at apex, margin toothed nearly to base; leaf cells much more than 25  $\mu$  in diameter; capsules generally clustered.....

16. Leaf cells reaching 80  $\mu$ , walls pitted; operculum apiculate.....  
Leaf cells reaching 40  $\mu$ , walls not pitted; operculum rostrate.....

17. Teeth of leaf border often of 2-3 cells; capsules normally single, rarely in 2's or 3's.....  
Teeth of leaf border usually of one cell only; plants very robust; capsules generally 3-6 from the same perichaetium, sometimes more.....

18. Leaf border not strongly differentiated, leaf cells tending to be long and narrow.....  
Border more clearly differentiated, leaf cells not so elongated.....

19. Plant of wide distribution, not infrequently fruiting.....  
Plants of high northern distribution, almost never fruiting.....

20. Leaves few and distant, somewhat bifarious.....  
Leaves closer and more numerous, not bifarious.....

1. *Menziesii*.  
2.  
3.  
18.  
2. *stellare*.  
4.  
3. *Blyttii*.  
5.  
4. *flagellare*.  
6.  
7.  
12.  
5. *hornum*.  
8.  
9.  
II.  
6. *orthorhynchum*.  
10.  
7. *lycopodioides*.  
10. *arizonicum*.  
8. *marginatum*.  
9. *spinulosum*.  
11. *venustum*.  
I3.  
12. *Drummondii*.  
14.  
15.  
17.  
13. *cuspidatum*.  
16.  
14. *medium*.  
17. *rostratum*.  
15. *affine*.  
16. *insigne*.  
18. *cinclidoides*.  
19.  
19. *punctatum*.  
20.  
20. *hymenophylloides*.  
21. *hymenophyllum*.

## 1. MNIUM MENZIESII (Hook.) C. Muell. Syn. 1: 177. 1848.

*Bryum Menziesii* Hook. Bot. Misc. 1: 36. pl. 19. 1828.

*Hypnum acanthoneuron* Schwaegr. Suppl. 3<sup>2</sup>: pl. 258b. 1829.

*Rhizogonium acanthoneuron* C. Muell. Bot. Zeit. 5: 803. 1847.

*Leucolepis acanthoneura* Lindb. Not. Faun. Fl. Fenn. Förh. 9: 81. 1868.

Plants erect, 4-8 cm. high, loosely tufted, matted with brown radicles in lower part, green or with reddish tinge; stem erect, stiff, straight to slightly flexuose, mostly dark purplish red, strongly angular, pentagonal in section with central strand, dendroid, with numerous small branches from upper part, the branches slender, spreading, often decurved, rarely reaching 2 cm. in length; stem leaves in lower part of stem distant, erect, closely appressed to stem, rather small and scale-like, whitish hyaline at least in upper part of leaf, slenderly lanceolate, long acuminate, decurrent, dentate throughout with slender single-celled teeth which stand out at right angles or nearly so to edge of leaf; costa broader at base, slender above, not reaching apex, not toothed; leaf cells in basal part of leaf chlorophyllose, more or less rectangular, rather small, up to  $35 \times 15 \mu$ , thick-walled, in upper hyaline part of leaf the cells much longer, up to  $100 \mu$ , thin-walled and empty of chlorophyll, the teeth being in this part only the projecting distal ends of elongated border cells, without, however, a distinctly differentiated border being formed. On upper part of stem the leaves less distant, broader, with normal irregularly rounded hexagonal chlorophyllose cells, except in acuminate point; teeth shorter and less prominent; costa stronger, slightly toothed dorsally. The branches issue from the stem at an angle between  $45^\circ$  and  $90^\circ$ , slightly above the axils of the upper stem-leaves, normally one to each leaf-axil; the branches are simple or themselves slightly branched, their leaves are closer, erect-spreading, somewhat crisped in drying, more ovate-lanceolate, with short acute apex, not hyaline, sharply toothed, especially in upper part; costa also sharply toothed dorsally, decurrent; cells chlorophyllose throughout. Perichaetial leaves reddish hyaline, lanceolate, long acuminate in toothed point; costa percurrent or very nearly so. Inflorescence terminating stem, dioicous; antheridia very numerous in a disk-shaped head, not protruded above branches; perigonal leaves relatively broad and short with prominent cuspidate point; antheridia brownish when ripe as are also the numerous clavate paraphyses; archegonia on separate plants, which however frequently fruit; their paraphyses slender, filiform. Seta erect, strong, somewhat flexuose, reddish, up to 5 cm. high; capsules single or 2, rarely 3 from the same perichaetium, more or less pendulous, up to 8 mm. in length, oval-cylindric, yellowish green to brown; operculum hemispherical with nipple-like projection at apex; annulus present; exothelial cells short, thick-walled, quadrangular to hexagonal, smaller and dark pigmented in 4 or 5 rows at mouth of capsule; stomata confined to short neck of capsule, cryptopore; outer and inner peristome of approximately equal length, both dark yellow, lighter toward tips of teeth, both papillose; outer teeth not bordered, lamellae very numerous and close, but not prominently projecting, sometimes connecting in lower part of tooth; segments of inner peristome widely gaping, with strong cross-bars and cuspidate toothed apex; cilia in 2's or 3's, well developed, but not appendiculate; spores round, greenish yellow, about  $30 \mu$ , papillose, ripening in spring. Type locality, probably southern Alaska (leg. Menzies).

ILLUSTRATIONS:—Hooker, l. c.; Schwaegr. l. c.; Engler-Prantl, Nat. Pflanzenf. 1<sup>3</sup>: f. 456; (Ed. 2) 10: f. 360; Pl. 102.

EXSICCATA:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 306; Holz. Musc. Acro. Bor. Am. 42; R. & C. Musc. Am. Sept. 182; Allen, Mosses Cascade Mts. 72; Grout, Musci Perf. 148; Bauer, Musc. Eur. et Am. Exsic. 1928; Verdoorn, Musc. Select. et Crit. 78.

Endemic to our Pacific coastal region, from southern Alaska to northern California, inland to Idaho. The species is a very distinct one and was made by Lindberg the type of a separate genus, but its characteristic features are mostly found also in other species of *Mnium*. Even its branching is not essentially different from that in *M. microphyllum* from Japan and China, or for that matter in *M. undulatum* from Europe, its branches are merely more numerous.

## 2. MNIUM STELLARE Reich. Fl. Moeno-Francf. 2: 125. 1778.

*Bryum stellare* Schrad. Syst. Samml. Krypt. Gew. 1: 15. 1796.

*Hypnum stellare* Web. & Mohr, Bot. Tasch. 294. 1807.

*Astrophyllum stellare* Lindb. Musc. Scand. 14. 1879.

Slender plants, loosely tufted, mostly 2-3 cm. high, green, rather matted with brownish radicles in lower part; stem simple, tending to be erect, but frequently curved, purplish red at least in lower part,

pentagonal in section with central strand; leaves erect-spreading, somewhat undulate or irregularly curved when dry, small and distant at base of stem, larger and closer above, elliptic-ovate, decurrent, obtuse to short pointed at apex, the upper ones denticulate on their upper border with broad unicellular teeth which project normally not in the plane of the leaf-blade, but at angles to it on either side, sometimes almost in pairs; costa fairly strong, reddish, *ceasing abruptly at some distance below the apex*, in section without stereid-bands; cells of leaf tending to be rounded hexagonal with thin walls and thickened corners,  $20-30 \mu$  in diameter, *the leaves generally described as not bordered, but the outer 1 or 2 rows of cells may be somewhat elongated or even slightly darker pigmented*. Dioicous; antheridia numerous in a terminal disk with more or less clavate paraphyses. Capsules not common, single; seta about 2 cm. high, reddish, erect, generally somewhat flexuose; capsule more or less pendulous, oblong with a short neck, somewhat bent and asymmetrical, brownish green, up to 3 mm. long; operculum convex, not pointed; annulus present, removable; exothelial cells thin-walled, tending to be hexagonal, gradually smaller and brown pigmented in some 6 rows bordering mouth of capsule; stomata in neck, cryptopore; outer peristome teeth greenish yellow, papillose, narrowly bordered, with numerous close but not connected lamellae; inner peristome dark yellow, with high basal membrane, segments broad and broadly fenestrated, abruptly contracted to a long slender awn-like toothed tip, finely papillose, cilia nodulose; spores around  $20 \mu$ , greenish yellow, ripening in May or June. Type locality, near Frankfurt a. Main, Germany.

ILLUSTRATIONS:—Hedw. Sp. Musc. pl. 45; Bry. Eur. pl. 401; Braithw. Brit. Moss Fl. 2: pl. 82D. M. H. M. 236. f. 121.

EXSICCATA:—Sull. Musc. Allegh. 90; Aust. Musc. Appal. 216; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 203, (Ed. 2) 305; Holz. Musc. Acro. Bor. Am. 398 (in part); Grout, Musc. Perf. 350.

Shady places in woods, on humus, New Brunswick and Ontario south to Virginia, west to Minnesota; also in Europe and Asia. The species does not belong in the group with non-toothed leaves, where it is placed by Brotherus (following Limpricht), but very clearly in the one with double-toothed leaves, as noted by Loeske.

3. *MNIUM BLYTTII* Br. & Sch. Bry. Eur. fasc. 31: 6. pl. 400. 1846.

*Astrophyllum Blyttii* Lindb. Musc. Scand. 14. 1879.

Close to the preceding species; of more robust erect growth, in often closely tufted plants. The leaves numerous and closely arranged, with a rather strong costa which may even be percurrent and in section shows a dorsal stereid-band; the leaf also clearly bordered throughout with 1 or 2 rows of narrow cells, which may be slightly toothed, the upper ones even in some cases with small double teeth. Inflorescence and fruit as in *M. stellare*; capsules uncommon; seta 3 cm. long, operculate capsule up to 5 mm. long; operculum convex without point; spores ripening later, in July or August. Type locality, Norway.

ILLUSTRATIONS:—Bry. Eur. pl. 400 (at right); Möller, Ark. f. Bot. 21A, No. 1: f. 14; Pl. 103.

EXSICCATA:—Holz. Musc. Acro. Bor. Am. 294.

Growing in moist places; extending in the Rocky Mt. region from the Yukon southward to New Mexico; also in northern Europe and Siberia. Herbarium specimens are sometimes mixed or confused with *M. hymenophyllum*.

4. *MNIUM FLAGELLARE* Sull. & Lesq. Proc. Am. Acad. 4: 277. 1859.

*Trachycystis flagellaris* Lindb. Acta Soc. Sci. Fenn. 10: 241. 1872.

*Rhizogonium flagellare* Paris, Index Bryol. 1110. 1897.

Plants loosely tufted, spreading, with brown radicles below, height not exceeding 2 cm., yellowish green; stems mostly simple, strong, flexuose, pentagonal in section with central strand, red; leaves erect-spreading, somewhat crispate when dry, not very numerous, somewhat larger and closer in comal part, decurrent, narrowly elliptic-ovate, obtuse to slightly acute at apex, with a swollen border of narrow elongated cells with sharp teeth, generally in pairs; costa strong, reddish, reaching apex of leaf, slightly toothed and dorsally roughened, in section showing a single (dorsal) stereid band; cells of leaf somewhat irregular in shape, tending to be isodiametric and rounded with thickened corners and moderately thick walls, small, hardly exceeding  $18 \mu$  in diameter, mamillose on both surfaces; from the axils of the comal leaves generally grow slender flagelliform branches with small distant scale-like leaves, which break off sharply at certain points and evidently serve as a means of vegetative reproduction. Dioicous; archegonia in terminal head with filiform hyaline paraphyses; antheridia numerous in broad terminal head, paraphyses numerous, slenderly clavate, yellowish; capsules occasional, single, borne on a slender red flexuose seta up to 2 or 3 cm. high, subpendulous, obovate, yellowish brown, up to 3 mm. long when deoperculate; operculum not seen,

represented in drawing as convex with sharp point; exothelial cells thick-walled, tending to be hexagonal, gradually smaller and darker brown pigmented in 8-10 rows at mouth of capsule; outer peristome teeth greenish yellow, inner peristome dark yellow; spores brownish yellow, papillose, about 20  $\mu$ , ripening (in Japan) in summer. Type locality, Japan.

ILLUSTRATIONS:—Correns, *Unters. f. 123*; Holz. & Frye, *Publ. Puget Sound Biol. Sta. 3: pl. 8; Pl. 103*. Found on Kodiak Island, Alaska by Miss Ruth Mylroie in 1911 and identified by Mr. R. S. Williams; it has recently been reported again from several localities in the Aleutian Islands by Bartram; otherwise known only from Japan and northeastern Asia. In its mamillose leaf-cells it agrees with *M. microphyllum* Doz. & Molk. from Japan and China, but its other characters show it to be none too closely related to that species, while it has very clearly affinity with the group with bidentate leaves.

5. *MNIUM HORNUM* L. Sp. Pl. 1112. 1753.

*Bryum hornum* Huds. Fl. Angl. 415. 1762.

*Hypnum hornum* Web. & Mohr, Ind. Mus. Pl. Crypt. 1803 (not seen).

*Astrophyllum hornum* Lindb. Musc. Scand. 14. 1879.

Plants slender, closely or loosely tufted, including lower dead parts sometimes up to 7 or 8 cm. high, green above, sometimes densely matted with brown radicles; stem simple, except rarely with a single slender subfloral branch, slender, more or less erect, but often somewhat flexuose, red or reddish at least in lower part, in section pentagonal with central strand; leaves erect-spreading, when dry somewhat undulate, numerous and closely placed, not notably tufted at summit, narrowly elliptic-ovate, somewhat decurrent, sharply acute to short acuminate, with a swollen border of darker narrow cells, more than one cell in thickness, with numerous double short but sharp teeth; costa strong, rather dark, *not reaching apex, somewhat toothed dorsally*, in section showing a dorsal stereid-band and a weak ventral one in lower part of leaf; cells of leaf-blade thin-walled, hardly thickened at corners, angular but irregular in size and shape, up to 35  $\mu$  in extreme cases, averaging 20-25  $\mu$ , tending to be isodiametric except in basal part where they become somewhat elongated with more thickened angles. Dioicous, but not infrequently fruiting; antheridia in a terminal rather large disk-shaped head, antheridia and especially paraphyses very numerous, the latter brownish, slenderly clavate, but tipped with 2 or 3 slender hyaline cells, the last one sharply pointed; archegonia in a smaller terminal head. Seta slender, erect, flexuose, generally 2-3 cm. high, reddish below, yellowish above; capsule single, horizontal to pendulous, oblong, symmetric, greenish brown, about 4 mm. long, sometimes slightly longer or shorter, abruptly narrowed into a short darker colored neck which passes gradually into the seta; calyptra rather large for the genus, cucullate, brownish; operculum short conical, pointed but not rostrate; annulus present, removable; exothelial cells rather large and thin-walled, isodiametric, irregularly quadrangular to hexagonal, gradually smaller, darker pigmented and more flattened in 5 or 6 rows at mouth of capsule, in neck portion small, rounded, thicker-walled and distinctly mamillose; stomata in neck; outer peristome teeth greenish yellow, finely papillose, with numerous close lamellae; inner peristome orange-yellow, papillose, basal membrane high, segments broadly fenestrate and finally gaping, terminating in a long narrow toothed point; cilia 2 or 3, very slender; spores greenish yellow, round, 25-30  $\mu$ , roughened, ripening in summer. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 390; Grout, M. H. M. f. 119; Möller, Ark. f. Bot. 21A, No. 1: f. 1; Pl. 105.

EXSICCATI:—Aust. Musc. Appal. 211; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 197, (Ed. 2) 296; Holz. Musc. Acro. Bor. Am. 173, 173a; Grout, Musc. Perf. 296.

On wet soil and rocks, especially in the Atlantic coastal region, where it extends from Labrador to Georgia, west to Ohio and Tennessee; collected once in Missouri, at Clayton by P. K. Lawrence in 1904. In Europe it is similarly a lowland plant and is reported also from Algeria.

6. *MNIUM ORTHORHYNCHUM* Brid. Sp. Musc. 3: 45. 1817.

*Mnium inclinatum* Lindb. Not. Soc. Faun. Flor. Fenn. Förh. 9: 48. 1868.

*Astrophyllum orthorrhynchum* Lindb. Musc. Scand. 14. 1879.

*Astrophyllum inclinatum* Lindb. Musc. Scand. 14. 1879.

*Mnium decurrens* C. M. & Kindb., Macoun Cat. Can. Pl. 6: 140. 1892.

*Mnium Macounii* Kindb. Rev. Bryol. 32: 33. 1905.

Plants slender and small, loosely tufted, generally 1-2 cm. high, sometimes higher, not much matted with radicles, green with reddish tinge; stem simple, slender, erect, more or less flexuose, red, in section

pentagonal with central strand; leaves erect-spreading, somewhat distant except in comal part, somewhat undulate and twisted when dry, decurrent, oblong-ovate with acute to short apiculate apex, bordered throughout with thickened border of narrow cells in more than one layer, with longer or shorter double teeth; costa rather strong, reddish, toothed dorsally, mostly percurrent, joining the border to form apiculus, in section mostly with 2 stereid bands; cells of leaf rather uniform, *small, rarely exceeding 20  $\mu$ , tending to be hexagonal* with fairly thin walls, corners slightly if at all thickened. Inflorescence dioicous, not commonly fruiting; antheridia in a terminal disk, with purplish clavate paraphyses, ending in 1 or 2 slender cells. Capsules single; seta slender, erect, about 2 cm. high, red or reddish; capsule tending to be horizontal, rather elongated and slender, when deoperculate 3 or 4 mm. long, reddish brown when ripe, oblong-cylindrical, straight, *contracted abruptly into a short narrow neck*; operculum short-rostrate, about 1.5 mm. long; annulus present, clinging somewhat to mouth of capsule; exothecial cells thin-walled, somewhat longer than broad, tending to be rectangular, gradually shortened in 3 or 4 rows at mouth of capsule, where they are not darker pigmented, though the annulus shows as a darker line when present; stomata in neck, cryptopore; outer cells of neck not rounded or mamillose; outer peristome teeth slender and gradually long-acuminate, light yellow below, darker toward apex, finely and densely papillose, very narrow-bordered, lamellae fairly close and numerous, rather prominently projecting; inner peristome golden yellow, with high basal membrane and rather short segments, which are widely fenestrated and pass abruptly into a long awn-like point; cilia 2 or 3, nodulose; spores greenish yellow, 30-40  $\mu$ , slightly roughened, ripening in summer. Type locality, Germany.

ILLUSTRATIONS:—Schwaegr. Suppl. 1<sup>2</sup>: pl. 78 (as *M. serratum* var.  $\beta$ ); Bry. Eur. pl. 391; Braithw. Brit. Moss Fl. 2: pl. 81D. Grout, M. H. M. pl. 51 (lower part); Möller, Ark. f. Bot. 21A, No. 1: f. 2; Pl. 105.

EXSICCATA:—Drumm. Musc. Am. 259 (as *Bryum marginatum*, in part); Aust. Musc. Appal. 208 (as *M. lycopodioides*); Holz. Musc. Acro. Bot. Am. 323 (as *M. lycopodioides*), 397; Grout, Musc. Perf. 184.

On rocks and ground in woods, especially on more or less calcareous substratum, widely distributed through the 3 northern continents; in North America noted from Alaska and Yukon south to New Mexico, in the eastern states to North Carolina.

7. *MNIUM LYCOPODIOIDES* (Hook.) Schwaegr. Suppl. 2<sup>2</sup>: 24. pl. 160. 1826.

*Bryum lycopodioides* Hook. ms., Brid. Bryol. Univ. 1: 853. 1826.

*Mnium umbratile* Mitt. Journ. Linn. Soc. Bot. 8: 30. 1865.

*Astrophyllum lycopodioides* Lindb. Musc. Scand. 14. 1879.

*Mnium pseudolycopodioides* C. M. & Kindb. (in part) Mac. Cat. Can. Pl. 6: 140. 1892.

Plants rather robust and tall, loosely tufted, up to 3 or even 4 cm. in height, somewhat radiculose below, lighter or darker green in upper growing parts; stems simple, erect, straight or somewhat flexuose, red or lighter reddish in upper part, in section pentagonal, *prominently winged with decurrent leaf-bases*, with central strand; leaves erect-spreading, numerous but somewhat distant, considerably curved and distorted or crispatate when dry, generally long and slenderly decurrent, the upper ones narrowly ovate-lanceolate, around 5  $\times$  1.7 mm., the lower more nearly ovate, apex acute to sharply acuminate, all bordered by a strong thickened border of narrow cells in more than one layer, toothed to near the base with prominent double teeth; costa rather strong, reddish, generally toothed dorsally in upper part, percurrent or excurrent, in latter case joining the border to form a strong apiculus, in section with 2 stereid-bands; cells of leaf varying considerably in size and form, from 20 to 30 or more  $\mu$ , irregularly rounded-hexagonal, with thin walls but definitely thickened corners. Dioicous, often without fruit; antheridia in a prominent terminal disk in separate plants, which may grow mingled with the archegonial ones, in which case capsules are likely to be found; the ♂ plants very robust, of equal or greater height than the others, their leaves more remote, wider and less strongly toothed, the perigonial leaves especially large and broad, antheridia numerous, paraphyses irregularly clavate. Capsules single, rarely 2 from the same perichaetium; seta strong, erect, straight or slightly flexuose, about 3 cm. high, pale reddish; capsules inclined to subpendulous, *rather large and long, subcylindrical, contracted abruptly into a narrow neck, often slightly curved, up to 7 mm. long when deoperculate*, greenish yellow, operculum short to long rostrate; annulus not very prominent, clinging to operculum; exothecial cells thin-walled, slightly elongated hexagonal, shortened but not strongly pigmented in 2 or 3 rows at mouth of capsule; stomata in neck, cryptopore; outer peristome-teeth yellow, gradually narrowed to apex, papillose, lamellae close and numerous; inner peristome golden yellow, with high basal membrane, segments slender, strongly keeled and widely fenestrated, cilia and segments densely papillose,

basal membrane barely roughened; spores greenish-yellow, 20-30  $\mu$ , roughened, *ripening in July*. Type locality, Nepal.

ILLUSTRATIONS:—Schwaegr. Suppl. 2<sup>2</sup>: *pl. 160* (lower part); Bry. Eur. *pl. 392*; Sull. Ic. Musc. Suppl. *pl. 35* (as *M. umbratile*); Möller, Ark. f. Bot. 21A, No. 1: *f. 5, 6*; *Pl. 104, Pl. 105, f. 3*.

EXSICCATI:—Allen, Mosses of Cascade Mts. 67 (as *M. umbratile*), 69 (as *M. orthorrhynchum*); Grout, Musci Perf. 122 (as *M. marginatum*).

On rocks by brooks; with us found occasionally in the northern tier of states, from Vermont to Washington, and northward in Canada, mostly in the west; also occasional in Europe and Asia. I have examined the type specimen in the Schwaegrichen Herbarium at Geneva and can see no reason for separating the European and North American material, though the species has been considerably confused with other related species. *M. riparium* Mitt. (1865) I am unable to recognize as a distinct American species. The latter name might well be discarded on nomenclatorial grounds alone, as it was originally merely a nomen nudum included as a synonym under *M. lycopodioides* in connection with the description of *M. umbratile*. In the following year (1866) H. Müller published a very detailed description and discussion of what is generally supposed to be the same thing under the name *M. ambiguum*, which name should then displace the other, if the supposition of identity is correct. Müller had already distributed his moss as a dioicous variety of *M. marginatum*. It does not seem to me impossible that the specimens referred to *M. riparium* may be in part such abnormal forms of *M. marginatum*, in part abnormal specimens of *M. lycopodioides* with slightly broader leaves; at any rate I have seen no American collections that justify the insertion of an independent species.

8. *MNIUM MARGINATUM* (Dicks.) Pal. de Beauv. Prodr. 75. 1805.

*Bryum marginatum* Dicks. Pl. Crypto. fasc. 2: 9. *pl. 5, f. 1.* 1790.

*Mnium serratum* Schrad. in L. Syst. Nat. (Ed. 13) 2: 1330. 1791.

*Bryum serratum* Schrad. Spic. Fl. Germ. 1: 71. 1794.

*Hypnum serratum* Web. & Mohr, Ind. Mus. Pl. Crypto. 1803 (not seen).

*Hypnum marginatum* Web. & Mohr, Bot. Tasch. 292. 1807.

*Astrophyllum marginatum* Lindb. Musc. Scand. 14. 1879.

*Mnium Niagareae* Kindb. Mac. Cat. Can. Pl. 6: 141. 1892.

Plants slender, loosely tufted, generally not more than 2, sometimes 3 cm. high, not much matted with radicles, green to slightly brownish; stems simple, slender, erect, somewhat flexuose, red or reddish, in section pentagonal with central strand; leaves erect-spreading, *rather distant and few, comal ones proximate but not forming a conspicuous rosette, much crisped and twisted when dry, decurrent, oblong-ovate, short-acuminate, bordered throughout with thickened often reddish-tinged border of more than one layer of narrow cells, with mostly rather short double teeth; costa rather strong, reddish, not toothed dorsally, often percurrent and joining border to form apiculus, in section with 2 stereid-bands; cells of leaf larger than in *M. orthorrhynchum*, up to 35  $\mu$ , thin-walled with thickened corners, somewhat quadrate and of rather uniform size, arranged in longitudinal rows, considerably elongated in basal region*. Synoicous, or rarely with archegonia alone, and commonly fruiting abundantly; antheridia and archegonia fairly numerous in a not very conspicuous terminal head, archegonial paraphyses filiform, antheridial clavate with one or more broader cells at summit. Capsules single; seta slender, erect, up to 2 cm. high, slightly reddish at least in lower part; capsule horizontal to somewhat pendulous, brownish yellow, oblong-cylindrical and sometimes slightly curved, rather abruptly narrowed into slender neck, varying in length, sometimes reaching 5 mm. without the operculum, the latter rostrate, up to 2 mm. long; annulus present, removable; capsule-walls thin; exothelial cells very thin-walled, somewhat elongated, shortened and strongly pigmented brown in 5 or 6 rows at mouth of capsule; stomata in neck, cryptopore; outer peristome-teeth rusty brown when mature, slightly bordered in upper part, densely papillose with prickly papillae; lamellae fairly numerous, close in lower part of tooth; inner peristome also brown and densely papillose, basal membrane high, segments broadly fenestrated, ending abruptly in a narrow cuspidate point, cilia slender, nodulose; spores yellow, about 25  $\mu$  or slightly more, finely roughened, *maturing in May*. Type locality, Europe.

ILLUSTRATIONS:—Dickson, l. c.; Bry. Eur. *pl. 391* (upper part); Grout, M. H. M. *pl. 51*; Möller, Ark. f. Bot. 21A, No. 1: *f. 10, 11*; *Pl. 105*.

EXSICCATI:—Drumm. Musc. Am. 259 (in part); Sull. Musc. Allegh. 95: Aust. Musc. Appal. 210; Sull. & Lesq. Musc. Bor. Am. 198, (Ed. 2) 297, 298 (in part); Bartram, Mosses South. Ariz. 37, 135.

On wet rocks by brooks, ground in woods, etc. Widely distributed in the three northern continents; in our eastern states it extends south in the mountains to Tennessee, in the central states to Missouri, in the west it occurs from the Yukon south to Arizona and New Mexico.

9. *MNIUM SPINULOSUM* Br. & Sch. Bry. Eur. fasc. 31: 4, pl. 394. 1846.

Plants loosely to closely tufted, usually about 1 cm. high, sometimes higher, green to yellowish-green, brown radicles confined to lower part of stem; stems simple, slender, erect, reddish at least in lower part, in section pentagonal with central strand; lower leaves very small and scale-like, distant, upper abruptly large and crowded into a tufted rosette, erect, more or less imbricate and not crisped when dry, decurrent, broadly obovate from a narrow base, short cuspidate, bordered throughout with a very strong thick border, which is round in section, *its inner cells stereid*, sharply double-toothed in upper part of leaf; costa very strong, green to slightly reddish, slightly excurrent, *not toothed dorsally*, in section with 2 stereid-bands; cells of leaf small, tending to be irregularly hexagonal, rather evenly thick-walled without thickened corners,  $18-25 \mu$ . Synoicous and generally fruiting abundantly; short clavate paraphyses in axils of leaves below the inflorescence, their slender lower cells yellow, the upper hyaline; antheridia and archegonia borne together in a terminal head with long filiform paraphyses. Capsules mostly single in our eastern states, in Europe and in our western states generally 2 or 3, or rarely more, together; seta 2-3 cm. high, erect, light reddish straw-color; capsule more or less pendulous, very light straw-color, almost whitish, *dark brown to purplish at mouth*, oblong-cylindrical, straight, about 3 mm. long when deoperculate, abruptly narrowed into slender neck which passes gradually into thickened and hooked summit of seta; operculum conical-rostrate; annulus present, clinging somewhat to mouth of capsule; capsule-walls thin; exothelial cells moderately thin-walled, tending to be slightly elongated hexagonal, shortened and darker pigmented in 3 or 4 rows at mouth of capsule; stomata in neck of capsule, cryptopore; *outer peristome-teeth dark purplish-brown*, bordered in upper part, papillose, divisural lines on dorsal surface strongly marked, lamellae numerous and close, but not prominently projecting; inner peristome also brown, papillose, basal membrane high, segments somewhat slender, fenestrated and narrowly acuminate, cilia rather prominent, nodulose; spores brownish yellow,  $15-20 \mu$ , minutely roughened, ripening May to June. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 394; M. H. M. 232, f. 118, f. g. h.

EXSICCATI:—Drumm. Musc. Am. 257; Aust. Musc. Appal. 209; Sull. & Lesq. Musc. Bor. Am. 202, (Ed. 2) 304; Holz. Musc. Acro. Bor. Am. 197; R. & C. Musc. Am. Sept. 308; Allen, Mosses of Cascade Mts. 68; Grout, Musci Perf. 121.

On ground in woods, especially under conifers; uncommon in Europe, from Pyrenees through the Alps to the eastward; not uncommon with us within its range: from Nova Scotia to Maryland in the east, extending from there across the continent, on the Pacific coast from Alaska to Oregon.

10. *MNIUM ARIZONICUM* Amann, Rev. Bryol. 52: 23. 1925.

Plants slender, loosely tufted, up to 1.5 cm. high, dark green, radicles not conspicuous, confined to basal part of stems; stems normally simple, erect, flexuose, brownish red in lower part, lighter above, pentagonal in section with central strand; leaves erect-spreading, closely set except on basal part of stem, which is nearly bare with a few scale-like leaves, much crisped and contorted when dry, slightly decurrent, narrowly to widely obovate from a narrow base, acute, bordered by 2 or more rows of narrow cells, the border often however somewhat indistinct, toothed only in upper part of leaf, with short, blunt, broad teeth, sometimes double, but often single only, sometimes nearly obsolete; costa fairly strong, reddish, not toothed dorsally, normally percurrent, but sometimes not reaching apex; cells of leaf rhomboidal to elongated-hexagonal, with longitudinal axis running diagonally from costa to border, up to  $40 \times 20 \mu$ , *walls rather thick, without especially thickened corners, much pitted*, in basal part of leaf elongated rectangular, *also pitted*. Dioicous, occasionally fruiting; antheridia numerous in a large terminal head, with broadly obovate very obtuse perigonial leaves arranged in a rosette, paraphyses long-clavate, hyaline. Capsules mostly single, rarely 2 from the same perichaetium; seta rather thick, at least in lower part, irregularly flexuose, about 2 cm. high, straw-colored, sometimes slightly reddish in lower part; capsule pendulous or subpendulous, rather small, about 2.5 mm. long without the beaked operculum, which adds about 1 mm., yellowish brown, nearly straight, gradually narrowing into short neck; annulus present, clinging somewhat to mouth of capsule; exothelial cells thin-walled, irregularly isodiametric or slightly elongated, passing rather abruptly into 2 or 3 rows of small isodiametric brown pigmented cells at mouth of capsule, those of neck outwardly convex, those of operculum evenly hexagonal; stomata in neck of capsule, cryptopore; outer peristome-teeth brown, passing to yellowish toward apex, gradually narrowing to apex, papillose, more coarsely so above, slightly bordered in upper part, lamellae rather numerous and close; *inner peristome golden yellow, papillose*, more coarsely so above; basal membrane fairly high, segments not so long as outer teeth, fairly

widely gaping, with long narrow tip; cilia apparently not well developed, sometimes 2 or 3, slender, short and cohering; spores (not fully ripe) about  $15 \mu$ , hyaline and apparently slightly roughened, ripening probably in August or September (specimens collected in late July had not yet fully ripened). Type locality, Arizona (E. B. Bartram).

ILLUSTRATIONS:—Bartram, Bryologist 29: 30; Pl. 99.

EXSICCATI:—Bartram, Mosses of Southern Arizona 72 (as *M. spinulosum*), 173; Holz. Musc. Acro. Bor. Am. 568.

On ground and humus in shade. Specimens have been seen from Arizona, New Mexico, Colorado (several collectors), Wyoming and Utah. The specimen listed in Lesquereux & James' Manual (Rocky Mts. leg. Downie) as *M. spinosum* (Voit) Schwaegr. has been examined and is clearly referable to *M. arizonicum*, *M. spinosum* being a European species not yet found in North America. *M. arizonicum* is however the American representative of the *M. spinosum* type and indeed closely related to that species, a fact overlooked by Amann. But the differences are such, even though mostly quantitative, that I have not ventured to treat the two as identical on the basis of the material available.

II. MNIUM VENUSTUM Mitt. Journ. Bot. and Kew Misc. 8: 231. pl. 12B. 1856.

*Mnium Nevii* C. Muell. Flora 31: 481. 1873.

Plants loosely tufted, sometimes growing with other mosses, up to 2 or 3 cm. high, green to yellowish green, with considerable growth of brown radicles toward base of stems; stems normally simple, erect but flexuose, sterile shoots often somewhat elongated *but not stoloniform*, round or nearly so in section, with central strand; leaves erect, numerous and closely set, except in lower part of stem, much crisped when dry, not very decurrent, broadly obovate-spatulate from a narrow base, sharply acuminate with a reflexed and involute apex, very distinctly bordered by 2 to 4 rows of narrow cells of single cell thickness, toothed throughout with single teeth, those in upper part of leaf very narrow and sharp, composed of a single cell; costa somewhat slender, green, excurrent; cells of leaf irregularly rounded hexagonal, varying in size, *up to 35  $\mu$* , with non-pitted walls and prominently thickened corners. Synoicous, paraphyses filiform; fruiting abundantly. Seta fairly slender, erect, slightly flexuose, up to 3 cm. high, yellow, slightly reddish below; capsules 1-4 from a perichaetium, horizontal to subpendulous, 3-4 mm. long when deoperculate, straight, oblong, yellow with well differentiated brown neck; operculum short, convex with nipple-like point; annulus present, clinging somewhat to operculum; exothelial cells irregularly hexagonal, with fairly thin walls and a tendency to thickening at corners, not perceptibly elongated, smaller in 2 or 3 rows at mouth of capsule, where they are only slightly darker-pigmented, in short neck darker, thick-walled and outwardly convex; stomata in neck, cryptopore; outer peristome-teeth very light yellow, gradually narrowing to apex, finely papillose below, more coarsely so above, slightly margined above, with close and numerous lamellae; *inner peristome darker golden yellow*, papillose, with rather high basal membrane, segments broadly fenestrata, cuspidate; cilia 2 or more, not prominent or strong, generally cohering; spores brownish, up to  $35 \mu$ , strongly papillose, ripening in spring or early summer. Type locality, "west coast of North America." (Menzies, Douglas.)

ILLUSTRATIONS:—Sull. Ic. Musc. Suppl. pl. 36; Pl. 100.

EXSICCATI:—Holz. Musc. Acro. Bor. Am. 120; Allen, Mosses Cascade Mts. 64; Bauer, Musc. Eur. et Amer. Exsic. 2029.

Ground and rocks in shade. Of characteristic Pacific coast distribution, from southern Alaska to northern California, inland to Montana.

12. MNIUM DRUMMONDI Br. & Sch. in Hook. London Journ. Bot. 2: 669. 1843.

*Astrophyllum Drummondii* Lindb. Musc. Scand. 14. 1879.

Plants loosely tufted, up to 2 cm. high, vivid light green, matted with brown radicles below; stems simple, the fertile ones erect, *the sterile ones somewhat stoloniform*, green to brownish, in section pentagonal, winged, with central strand; leaves fairly numerous, spreading, *not much crisped when dry*, closely placed on upper part of fertile stems, less so and somewhat distichous on sterile ones, decurrent, few lower ones remote and scale-like, gradually increasing in size upward, on stoloniform ones decreasing again on the deflexed part, broadly obovate-spatulate, short acuminate, bordered by 2-4 rows of cells of single thickness, toothed *in upper part only with single sharp teeth* mostly of one cell; costa slender except at base, green, percurrent; cells of leaf nicely hexagonal with straight thin walls, not pitted, corners not thickened, up to  $40 \mu$ . Inflorescence heteroicous, terminal, normally synoicous, but large antheridial heads with broad perigonial

leaves and more or less clavate paraphyses may also occur, even in the same tufts with the synoicous plants; seta slender, red or reddish, erect, somewhat flexuose, up to 3 cm. high; capsules generally present, 1-4 or even 5 from the same perichaetium, pendulous, oblong, 3 mm. or less when deoerculate, light yellow, neck short and inconspicuous; operculum similarly light in color, convex with a sharp point; annulus present, removable; walls of capsule thin, exothecial cells rather thick-walled, irregularly shaped, tending to be slightly elongated, shortened in 5 or 6 rows at mouth of capsule, which are slightly darker yellow-pigmented, those of neck not convex; stomata in neck, less strongly cryptopore than in other species; outer peristome-teeth light greenish-yellow, gradually narrowing to apex, bordered in upper part, finely papillose below, more coarsely so above, lamellae numerous and close; inner peristome brownish yellow, finely papillose, with high basal membrane, segments nearly as long as outer teeth, broadly fenestrate, slenderly cuspidate, cilia 2 or 3, well developed, strongly nodulose or slightly appendiculate; spores yellow, papillose, about  $22 \mu$ , ripening in May or June. Type locality, western British America.

ILLUSTRATIONS:—Sull. Ic. Musc. pl. 51; Möller, Ark. Bot. 21A, No. 1: f. 23-25; Pl. 100, Pl. 101C.

EXSICCATI:—Drumm. Musc. Am. 257 (as *Bryum spinosum*); Aust. Musc. Appal. 515; Sull. & Lesq. Musc. Bor. Am. 199, (Ed. 2) 299; Holz. Musc. Acro. Bor. Am. 293, 293a; Grout, Musc. Perf. 328.

Ground and rocks in shade, extending in a narrow belt across our northern tier of states from Maine to Washington and somewhat northward in Canada, in the eastern states reaching south to Maryland and Pennsylvania; also in northeastern Europe and reported from Siberia.

13. *MNIUM CUSPIDATUM* (L.) Leyss. Fl. Hal. 272. 1783. Hedw. Sp. Musc. 192 (in part), pl. 45, f. 5, 6, 8. 1801; not Necker, Act. Ac. Theod. Palat. 2: 444. 1770.

*Mnium serpyllifolium*  $\beta$  *cuspidatum* L. (in part) Sp. Pl. 1113. 1753.

*Mnium sylvaticum* Lindb. Not. Soc. Faun. Flor. Föhr. 9: 59. 1868.

*Astrophyllum sylvaticum* Lindb. Musc. Scand. 14. 1879.

Plants widely spreading, often in large mats, up to 2 cm. high, rarely higher, light to yellowish green, with considerable growth of dark radicles below; fruiting stems simple, erect; sterile stems stoloniform, creeping or deflexed, often considerably elongated, green, pentagonal in section with central strand; leaves few, remote and small in basal part of stem, gradually closer and larger above, especially in comal region, spreading, much crisped and distorted when dry, obovate from a narrow base, decurrent, acute to short acuminate, bordered by 2-4 rows of narrow cells in single thickness, toothed in upper part with single acute teeth, composed of single cells; costa rather strong, green, percurrent; cells of leaf irregularly rounded-hexagonal, tending to be small, but with larger ones intermingled, up to  $25 \mu$ , walls rather thick, but not pitted, with decided thickenings in corners. Synoicous, paraphyses mostly filiform; seta slender, erect, flexuose, slightly reddish yellow, up to 3 cm. high, thickened and cygneous below its junction with neck of capsule; capsules usually abundant, single, pendulous, oblong to oval, up to 3.5 mm. in length when deoerculate, yellow to brownish yellow when mature, neck very short; operculum of same color, rather large, high convex without noticeable point; annulus present, removable; walls of capsule thin, exothecial cells rather thick-walled, irregularly shaped, slightly elongated, gradually shortened in 4 or 5 rows at mouth of capsule, which are not darker pigmented, but may appear so by the darker base of peristome shining through; cells of neck not convex; stomata in neck, cryptopore; peristome attached somewhat below mouth of capsule, outer teeth greenish yellow, gradually narrowing to apex, finely papillose below, more coarsely above, border above very narrow or almost lacking, lamellae close and numerous; inner peristome brown, finely papillose, basal membrane high but very conspicuously lacunose, segments broadly fenestrate, ending in an awn-like tip which reaches same height as outer teeth, cilia 3 or 4, strong and prominently nodulose; spores yellow,  $20-25 \mu$ , slightly papillose, ripening in April and May. Type locality, Europe.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. pl. 396; Grout, M. H. M. f. 117 d, e, f; Möller, Ark. Bot. 21A, No. 1: f. 18, 19; Pl. 101D.

EXSICCATI:—Drumm. Musc. Am. 258 (as *Bryum cuspidatum*); Sull. Musc. Allegh. 94; Aust. Musc. Appal. 204; Sull. & Lesq. Musc. Bor. Am. 200, (Ed. 2) 300; Holz. Musc. Acro. Bor. Am. 97, 541; Ren. & Card. Musc. Am. Sept. 62, 62b; Grout, Musc. Perf. 52; Bartr. Mosses South. Ariz. 41.

On ground in woods and fields, very common, throughout the United States, extending northward into Canada; also in Europe and Asia. Not to continue the confusion caused by the use of the name *cuspidatum* for two species I have employed it as fixed by Hedwig (1801), though admitting that the reasoning of Lindberg was not entirely without justification and though the plate of Hedwig represents this species only in part.

14. MNIUM MEDIUM Br. & Sch. Bry. Eur. fasc. 5: 32, pl. 398 (lower part). 1838.

*Astrophyllum medium* Lindb. Musc. Scand. 14. 1879.

Plants loosely tufted, up to 3 cm. or slightly more in height, light to yellowish green, much matted below with brown radicles; fruiting stems simple, erect, sterile stems not numerous, deflexed, not much longer than others, green, pentagonal in section with central strand; leaves rather few and distant, except in comal portion, spreading and crisped when dry, decurrent, broad oval to slightly obovate, short cuspidate, bordered by 2-3 rows of narrow cells in single thickness, *toothed throughout with single sharp teeth of one cell each*; costa strong, percurrent, combining with border cells to form cuspidate apex; cells of leaf irregularly rounded-hexagonal, not much lengthened in oblique direction, *very large toward costa where they reach dimensions of 80  $\mu$* , gradually smaller toward border down to about half, walls thicker or thinner, *prominently pitted and with distinct corner-thickenings*. Syncous, antheridia and archegonia varying in relative proportions, archegonia tending to be central and antheridia peripherally disposed, paraphyses numerous, long filiform with acute apex; capsules generally present, *often numerous, 1-3 from the same perichaetium*; seta slender, erect, flexuose, furrowed when dry, reddish below, becoming pale and yellowish above, up to 5 cm. long; capsule pendulous, oblong, 3-4 mm. long when deoerculate, yellow to light brown, with short and inconspicuous neck; operculum convex, apiculate; annulus present; walls of capsule thin; exothecial cells rather thick-walled, slightly elongated hexagonal, shortened and brownish pigmented in 3 or 4 rows at mouth of capsule; stomata in neck, strongly cryptopore; outer peristome-teeth yellow, gradually narrowed to apex, very papillose, narrowly bordered, dorsal divisural line zig-zag in lower part, ventral lamellae fairly close and numerous, those of middle portion prominently projecting; *inner peristome orange*, papillose, basal membrane fairly high, not perforated, segments widely gaping, apex long, slender awl-shaped, dentate; cilia slender, slightly nodulose, spores dark yellow, 20-25  $\mu$ , papillose, ripening in April and May. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 398; Möller, Ark. Bot. 21A, No. 1: f. 20, 21, 22; Pl. 101.

EXSICCATI:—Aust. Musc. Appal. 206 (in part); Holz. Musc. Acro. Bor. Am. 98; R. & C. Musc. Am. Sept. 307.

Occasional on wet ground in woods and by brooks, across our northern states from New England to Washington, south to Maryland and California, northward through Canada to Alaska, Yukon and Greenland; also in Europe and Asia.

15. MNIUM AFFINE Bland. in Schwaegr. Suppl. 1<sup>2</sup>: 134. 1816.

*Bryum affine* Brid. Musc. Recent. Suppl. 4: 119. 1819.

*Bryum ciliare* Grev. Ann. Lyc. Nat. Hist. N. Y. 1: 273, pl. 23. 1825.

*Mnium rugiculum* Laurer, Flora 10, I: 292. 1827.

*Mnium ciliare* Lindb. Bot. Notiser 1878: 188.

*Astrophyllum cuspidatum* Lindb. Musc. Scand. 13. 1879.

*Astrophyllum ciliare* Lindb. Musc. Scand. 14. 1879.

*Astrophyllum rugiculum* Kindb. Bih. K. Svensk. Vet.-Akad. Handl. 7, No. 9: 61. 1883.

*Mnium macrociliare* C. M. & Kindb. (in part), Mac. Cat. Can. Pl. 6: 137. 1892.

Plants closely to loosely tufted, up to 3 or more cm. in height, green, generally matted below with brown radicles; fertile stems simple and more or less erect, sterile stems often numerous, deflexed to horizontal, sometimes considerably lengthened and rooting at tip, all green, pentagonal in section with central strand, leaves small and distant in lower part of stem, becoming larger and closer above, forming a rosette in comal part of fertile stems, on sterile shoots again becoming smaller and more distant toward tip, spreading, crisped or irregularly distorted when dry, sometimes more or less decurrent, oval to obovate, on sterile shoot more elongated, short cuspidate, bordered by 2-4 rows of narrow cells in single thickness, usually toothed throughout with sharp teeth of 1-3 cells each, the teeth however in some forms much reduced to almost entirely lacking; costa strong, percurrent, ending in cuspidate apex; cells of leaf more or less hexagonal, tending to be slightly elongated in oblique direction from costa to border and arranged in rows, moderately thick-walled, not strongly thickened in corners with walls pitted, up to 50  $\mu$  or more in longest diameter, largest toward costa, gradually smaller toward border. Dioicous, ♂ and ♀ plants often mingled and capsules produced, but also frequently separate and capsules not produced; antheridia numerous in a disk-shaped head with broad perigonial leaves, paraphyses numerous, clavate with blunt or rounded apex. Seta slender,

reddish below, paler and yellowish above, generally about 3 cm. long; capsules mostly single, rarely 2 or 3 from the same perichaetium, pendulous, oblong, about 5 mm. long, sometimes longer or shorter, brownish yellow, sometimes lighter or darker, neck short and inconspicuous; operculum short-convex or broadly conical, apiculate; annulus present; exothelial cells fairly thick-walled, somewhat irregular in size and shape, tending to be slightly lengthened, except 4-6 rows at mouth of capsule, which are shortened and darker pigmented; stomata in neck, cryptopore; outer peristome-teeth greenish yellow, gradually narrowed to apex, densely papillose, very narrowly bordered, lamellae numerous and very close in lower part of tooth; inner peristome orange, densely papillose, basal membrane high, not perforated, segments broadly fenes- trate to gaping, cuspidate and prominently appendiculate at apex, cilia strongly nodulose to short ap- pendiculate; spores yellow, around  $25 \mu$ , papillose, ripening in spring. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. *pl. 397*; Möller, *Ark. Bot. 21A*, No. 1: *f. 26-33*; Grout, *M. H. M. pl. 49*; *Pl. 101*.

EXSICCATI:—Drumm. *Musc. Am. (S. States)* 79, 80; Aust. *Musc. Appal.* 205; Sull. & Lesq. *Musc. Bor. Am. 201*, (Ed. 2) 301, 302, 303; Holz. *Musc. Acro. Bor. Am.* 247 (as *M. ciliare*), 413; Grout, *Musci Perf.* 54.

Common on moist ground in woods, meadows and swamps, throughout the United States and northward to Greenland and Alaska; also Europe and Asia and reported from southern South America. Variations in growth and leaf-characters have led to the separation of certain forms which are variously treated by bryologists as distinct varieties or even species, such as var. *rugicium* (Laur.) Br. & Sch., var. *ciliare* (Grev.) C. M., etc., but I have been quite unable to find any basis for taxonomic grouping of such forms. *M. Seligeri* Jur., an erect growing swamp-form with more decurrent leaves than usual, is regarded by many European bryologists as a distinct species; it is not well represented with us, though occasional forms approaching it occur. It forms something of an approach to the following species (*M. insigne*), in fact was included with it in Mitten's original description. The name *M. affine* seems so well established by Blandow's exsiccati-specimen and Schwaegrichen's description that one hesitates to try to make out a doubtful case for earlier ones, particularly if one leaves the Linnean name *M. cuspidatum* to the other species, which formed a part of Linné's material.

16. *MNIUM INSIGNE* Mitt. *Hook. Journ. Bot. and Kew Misc.* 8: 230 (in part). 1856;  
Sull. *Ic. Musc. Suppl.* 53, *pl. 37*. 1874.

Plants loosely tufted, very robust, up to 6 or more cm. in height, yellowish green, matted below with brown radicles; fertile stems simple, erect, sterile stems not numerous, flexed, mostly brownish, pentagonal in section with projecting leaf bases, with central strand; leaves smaller and more distant in lower part of stem, becoming large and close in comal region of fertile stems, spreading, strongly recurved and distorted when dry, very prominently and long decurrent, narrowly elliptical, acuminate, bordered by mostly 3 rows of narrow cells in single thickness, toothed throughout, teeth of lower part of leaf short and blunt, those of apical part sharp, mostly of a single cell each; costa strong, percurrent or nearly so; cells of leaf irregularly rounded hexagonal, not elongated nor arranged in oblique rows, up to  $50 \mu$  in diameter, walls rather thick and pitted, corners strongly thickened. Dioicous, antheridia in a disk-shaped head with broad perigonial leaves, very numerous, paraphyses also very numerous, large, clavate. Capsules produced very abundantly in specimens available, 1-9 per perichaetium, most frequently 3-6; seta rather thick and reddish below, slender and yellow above, considerably ribbed and grooved when dry, erect, flexuose, up to 3 cm. long; capsule pendulous, oblong, about 5 mm. long, yellowish brown when ripe, neck short, passing abruptly into seta; operculum broadly conical, apiculate to almost short-rostrate; annulus present; exothelial cells thick-walled, tending to be slightly elongated-hexagonal, gradually shortened in 6 or more rows at mouth of capsule, the last 2 or 3 rows more darkly pigmented; stomata in neck, cryptopore; outer peristome teeth greenish yellow, gradually narrowed to apex, densely papillose, very narrowly bordered, lamellae numerous and close below, very prominently projecting; inner peristome orange, papillose, basal membrane high, not perforated, segments broadly gaping, cuspidate and appendiculate, cilia slender and fragile, slightly if at all nodulose; spores dark yellow, papillose, about  $25 \mu$ , ripening in April or May. Type locality, western North America.

ILLUSTRATIONS:—Sull. *Ic. Musc. Suppl. pl. 37*; *Pl. 104*.

EXSICCATI:—Allen, *Mosses of Cascade Mts.* 65.

Moist ground along brooks, etc., a plant of the Pacific coastal region, occasional from Alaska to northern California, inland to northwestern Montana. The name is not very well founded, as Mitten apparently had primarily in mind European specimens which would answer to the present conception of *M. Seligeri* Jur. If the latter is to be regarded as a species separate from *M. affine*, Mitten's name would antedate it. As I am unable to see a distinct species in *M. Seligeri* I have retained the name *insigne* as based upon the western American specimens included by Mitten and later established by Sullivant's description and plate.

17. MNIUM ROSTRATUM Schrad. in Linn. Syst. Nat. (Ed. 13) 2<sup>2</sup>: 1330. 1791.

*Bryum rostratum* Schrad. Spic. 72. 1794.

*Mnium longirostrum* Brid. Musc. Recent. 2<sup>3</sup>: 106. 1803.

*Hypnum rostratum* Web. & Mohr, Bot. Tasch. 296. 1807.

*Bryum longirostrum* Brid. Musc. Recent. Suppl. 4: 119. 1819.

*Astrophyllum rostratum* Lindb. Musc. Scand. 13. 1879.

Also an extensive synonymy from regions other than Europe and North America.

Plants loosely spreading and intertwined, not very robust, hardly exceeding 2 cm. in height and generally less, though the sterile shoots may run up to 5 or 6 cm. in length, light or darker green, with considerable development of brown radicles in lower part; fertile stems simple, erect, short, with leaves mostly in a rosette at the top, sterile shoots numerous, deflexed to prostrate, often considerably elongated, with somewhat distant leaves flattened in 2 ranks, roundish to slightly pentagonal in section with central strand. Leaves often rather large, spreading, irregularly wrinkled and distorted on drying, narrowed abruptly at base and very slightly decurrent, broadly obovate, very short cuspidate, bordered by 3-5 rows of narrow cells in single thickness, *toothed nearly to base, generally with inconspicuous short blunt teeth of a single cell each*; costa strong, generally ending in the cuspidate apex; cells of leaf irregularly rounded-hexagonal with somewhat thickened *but not pitted walls and considerably thickened corners*, slightly lengthened in oblique direction of leaf, *hardly exceeding 40  $\mu$  in greatest dimension*, generally less. Syncarpous, paraphyses filiform to sub-clavate; capsules usually present, *often numerous, 1-3 from the same perichaetium*. Seta slender, reddish below, yellowish above, 2 cm. long or rarely longer, erect, flexuose; capsule horizontal to pendulous, oblong, often somewhat curved, hardly exceeding 3 mm. in length when deoperculate, yellowish, brown near mouth, neck longer than in preceding species, not sharply set off, gradually narrowing into seta, usually somewhat curved; operculum pale in color, long rostrate; annulus present; capsule-walls thin; exothecial cells thin-walled, tending to be slightly elongated-hexagonal, gradually shortened and smaller and dark-pigmented in about 6 rows at mouth of capsule; stomata not confined to neck but distributed over capsule, cryptopore; outer peristome teeth greenish yellow, densely papillose, broad below, passing somewhat abruptly into a slender apex which is narrowly bordered, lamellae close in lower part; inner peristome orange, papillose, basal membrane fairly high, somewhat perforated especially in part below segments; segments long, broadly fenestratae passing more gradually than in most species into the long slender appendiculate tip, the gaps continuing in narrower slits well up toward this narrow tip; cilia long and well developed, strongly nodulose or subappendiculate; spores yellow, about 20-25  $\mu$ , slightly roughened, ripening May to July. Type locality, Europe.

ILLUSTRATIONS:—*Bry. Eur.* pl. 395; *Braithw. Brit. Moss Fl.* 2: pl. 81F; *Grout, M. H. M.* pl. 50.

EXSICCATA:—*Sull. Musc. Allegh.* 91; *Aust. Musc. Appal.* 207; *Holz. Musc. Acro. Bor. Am.* 324; *Allen, Mosses of Cascade Mts.* 66.

Moist ground and rocks in woods; of wide distribution through our territory, but apparently not common anywhere, or at any rate not often collected; seemingly better represented in the southern part of our range. Many of the specimens under this name in American herbaria represent other species. The species is cosmopolitan or nearly so and is the only member of the *Mniaceae* to attain such world-wide distribution.

## 18. MNIUM CINCLIDIOIDES Hüb. Muscol. Germ. 416. 1833.

*Astrophyllum cinclidioides* Lindb. Musc. Scand. 13. 1879.

Plants loosely tufted, large, 5 cm. (or often much more) in height, green, with some development of brown radicles in lower part; stems more or less erect, often flexuose, *brownish*, more nearly green in upper part, more or less pentagonal in section, with strong central strand; leaves large up to 9  $\times$  5 mm., distant, spreading, arranged more or less in two rows, irregularly undulate and distorted when dry, narrowing gradually to base and not decurrent, obovate, rounded, or with a short blunt point at apex, *without a distinct border, though the cells of border region are gradually narrowed in several rows and may show a few short blunt teeth*; costa slender, not reaching apex; cells of leaf-blade so elongated in oblique direction from costa outward as to appear rhomboidal, up to 125  $\times$  30  $\mu$  near the costa, gradually smaller toward the edge of leaf, where 3 or 4 rows of narrower cells elongated in the direction of edge of leaf form an approach to a border, walls thin and pitted, not thickened in corners. Dioicous; capsules very rare, found only in the northern part of its range; antheridia in a large terminal disk-shaped head with rosette of few large broad perigonial

leaves, both antheridia and paraphyses numerous, the latter more or less clavate; seta long and slender, dark purplish red below, reddish above, up to 6 cm. or more in length, erect, flexuose; capsules mostly single, pendulous, short and thick, oval with a short neck, passing into the thickened and much crooked top of seta, hardly exceeding 3 mm. in length when deoperculate, brown when ripe; operculum convex, apiculate; annulus present; capsule walls thick; exothelial cells thin-walled, irregularly rectangular to hexagonal, not much if at all lengthened, smaller, flattened, thicker-walled and darker pigmented in about 6 rows at mouth of capsule; stomata in neck of capsule, strongly cryptopore; outer peristome teeth brown, darker than inner peristome, papillose, lamellae very numerous and close, projecting not prominently, but somewhat more at either side than in the middle (retuse); inner peristome lighter yellowish brown, papillose, basal membrane relatively low, segments somewhat narrow and widely gaping, with perforations continuing down nearly through basal membrane; cilia 2-4, strong, often somewhat coalesced, strongly nodulose; spores brownish yellow, varying considerably in size in the same capsule, up to  $35\ \mu$  or more, minutely roughened, ripening May-June. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 402; Möller, Ark. Bot. 21A, No. 1: f. 36, 37; M. H. M. 235. f. 120.

EXSICCATI:—Aust. Musc. Appal. 214, 215; Sull. & Lesq. Musc. Bor. Am. 196b, (Ed. 2) 295; Holz. Musc. Acro. Bor. Am. 147; R. & C. Musc. Am. Sept. 224; Reliquiae Farlowianae 561; Grout, Musci Perf. 346.

In swamps and bogs, a northern species extending from Greenland to Alaska and southward in the glaciated region in peat-bogs to Connecticut, New Jersey, Pennsylvania, Michigan, Minnesota, Montana, British Columbia; also in Europe and northern Asia. The species is generally supposed to have been first distinguished and named by Blytt, but was not credited to him in the original publication.

19. *MNIUM PUNCTATUM* (L.) Hedw. Fund. 2: 94. 1782.

*Mnium serpyllifolium*  $\alpha$  *punctatum* L. Sp. Pl. 1113 (in part). 1753.

*Bryum punctatum* Schreb. Spic. Fl. Lips. 85. 1771.

*Hypnum punctatum* Schrank, Baiersch. Fl. 2: 470. 1789.

*Mnium pseudopunctatum* Br. & Sch. Lond. Journ. Bot. 2: 669. 1843.

*Bryum mniooides* Wils. Lond. Journ. Bot. 3: 427. 1844.

*Mnium subglobosum* (Hpe. ms. as var.) Br. & Sch. Bry. Eur. fasc. 31: 3, pl. 388. 1846.

*Astrophyllum punctatum* Lindb. Musc. Scand. 13. 1879.

*Astrophyllum pseudopunctatum* Lindb. Musc. Scand. 13. 1879.

*Mnium glabrescens* Kindb. Ottawa Natural. 7: 18. 1893.

*Mnium nudum* R. S. Williams, Bryol. 3: 6. 1900.

Plants loosely tufted or sometimes more scattered or intermixed with other mosses, up to 5 cm. or occasionally more in height, whitish or lustrous green or darker, sometimes with reddish tints, often much felted with brown radicles, especially the taller forms; stems often strong and more or less erect, lighter or darker red, pentagonal in section with central strand, mostly simple; leaves large, distant except in comal region, spreading, commonly more or less wrinkled and distorted in drying, gradually narrowing to base, not or but slightly decurrent, oval to more commonly obovate-spatulate, broadly rounded to slightly emarginate at apex, with a distinct border, not toothed, the border sometimes reddish, of 1 or more layers of narrow cells, 1 or more cells in width; costa fairly strong, at least in lower part, ceasing below apex or percurrent, sometimes uniting with border to form a short blunt point at apex, biconvex in section and without stereid bands; cells of leaf irregularly hexagonal to nearly rhomboidal, frequently elongated and arranged in rows in oblique direction from costa to border, up to  $150 \times 50\ \mu$ , sometimes half as large or less, normally shorter and smaller toward border, walls thin without pits or thicker and pitted, corners not or slightly thickened. Generally dioicous, varying to synoicous, capsules occasional; antheridia in dioicous forms in terminal disk-shaped head with few rather large perigonal leaves, paraphyses numerous, clavate, golden yellow, longer than the paler antheridia. Seta long and slender, mostly 2-4 cm. in height, reddish, darker and thicker in lower part. Capsules generally single, horizontal to pendulous, ovoid to oblong-cylindrical, light yellowish to brownish, up to 5 mm. long when deoperculate, neck short and inconspicuous; operculum conical-rostrate; annulus present; exothelial cells thick-walled, irregularly hexagonal, not lengthened, smaller and brown-pigmented in 2-4 rows at mouth of capsule; stomata in neck of capsule, cryptopore; outer peristome teeth brown to yellow, narrowly bordered, papillose, papillae in upper part sometimes appearing to be arranged in longitudinal stripes, lamellae more or less numerous and more or less close in lower part; inner peristome golden yellow, papillose, basal membrane high, not perforated, segments com-

paratively narrow, gradually narrowing to slender apex, fenestrata, cilia 2 or 3, more or less strong and nodulose, sometimes more or less coalesced; spores rather large, 35-40  $\mu$ , brownish yellow, roughened, ripening in winter or spring according to locality. Type locality, Europe.

ILLUSTRATIONS:—Bry. Eur. pl. 387, 388; M. H. M. f. 118, a-e.

EXSICCATI:—Drumm. Musc. Am. 253, 254; Aust. Musc. Appal. 212, 213; Sull. Musc. Allegh. 93; Sull. & Lesq. Musci Bor. Am. 196, (Ed. 2) 294; Holz. Musc. Acro. Bor. Am. 119, 148, 295; Allen, Mosses of Cascade Mts. 70, 71; Grout, Musci Perf. 86.

On wet rocks by brooks and in wet ground generally, by springs, brooks and in swamps and bogs. Widely distributed from Greenland to Alaska, southward to Georgia, Ohio, Michigan, Wisconsin, Minnesota, Colorado, California; also in Europe and Asia. Variable in many of its features. Of the different characters that have been employed to separate *M. pseudopunctatum* (*M. subglobosum*) none, even its synoicous inflorescence, appears to correlate with any others and it seems impossible to distinguish under this name even a clearly marked variety. The variety *elatum* Schimp. Syn. 398 (1860) is characterized only by relative robustness, lack of fertility and large size of its parts and can be separated only arbitrarily from other forms. *M. glabrescens* Kindb. has often been regarded as a valid species of the Pacific coastal region and may give somewhat that impression, but presents no characters that definitely separate it. Its leaf-cells average smaller than usual, but vary greatly even in the same leaf. As a name, the *M. serpyllifolium* of Linné seems to me to have priority, but as *M. punctatum* is both established by long usage and employed by Hedwig I have retained it.

20. MNIUM HYMENOPHYLLOIDES Hüb. Muscol. Germ. 416. 1833.

*Bryum hymenophylloides* Hartm. Skand. Fl. (Ed. 3) 292. 1838.

*Astrophyllum hymenophylloides* Lindb. Musc. Scand. 14. 1879.

Plants rather loosely tufted or scattered, frequently intermingled with other mosses or even with other species of *Mnium*, rarely more than 2 cm. in height, frequently less, bright green to yellowish or brownish green, sometimes with more or less lustre, becoming brown in lower parts, where there is generally a considerable development of brown radicles; stems slender, brittle, more or less erect, flexuose, somewhat branching, dark brown to nearly black, pentagonal in section with central strand; leaves small and not numerous, erect, somewhat bifarious, not much distorted in drying, not decurrent, broadly oval, usually with a small blunt apiculus, bordered throughout with 2-3 rows of narrow cells in single thickness; costa fairly strong, brownish toward base, generally ceasing shortly below apex, in section showing a single stereid band; cells of leaf varying somewhat in size, irregularly hexagonal, up to 35  $\mu$  in diameter, not much different in basal region, walls rather thick and with thickened corners, much pitted, chloroplasts very numerous, near the walls, cuticle strongly granular-roughened. Dioicous, antheridia not yet found; archegonia terminal without protection of a rosette of leaves, few, dark in color, with filiform paraphyses of about equal length; capsule not seen. Type locality, Norway.

ILLUSTRATIONS:—Bry. Eur. pl. 399; Möller, Ark. f. Bot. 14, No. 3: 43 (capsule); 21A, No. 1: f. 38; Pl. 108.

In clefts of and about rocks, calciphile; reaches the United States in Maine and Vermont and northern New York; in Canada correctly named specimens have been seen from New Brunswick, from the Rockies and from Ellesmere Land in the Arctic; it occurs in Europe in the Alps and Scandinavia and is reported from Spitzbergen and Siberia. Doubt has been cast upon Hübener's original inadequate description of the capsule; since then only a single deoperculate capsule has been found, viz. in Sweden by Persson, who furnished a description and illustration in the Ark. f. Bot. 14 (1915), as noted above. The species is clearly a *Mnium*, but not too closely related to any other except the following one.

21. MNIUM HYMENOPHYLLUM Br. & Sch. Bry. Eur. fasc. 31: 5. pl. 400. 1846.

*Cinclidium hymenophyllum* Lindb. Not. Soc. Faun. Flor. Fenn. Förh. 9: 75. 1868.

Closely related to the preceding species; differs in the following respects: plants taller and sometimes more branched, up to 4 or 5 cm. high and said to grow much higher, densely matted with brown radicles in lower part, the ultimate shoots long, straight and sometimes almost flagelliform, often with appressed leaves, which may become gradually smaller upward; leaves closer and more numerous, not bifarious, laxer, decurrent, broadly ovate, with obtuse apex, border often of only 1 row of broader but elongated cells, leaf cells otherwise more nearly square or rectangular, somewhat larger, up to 50  $\mu$ , especially elongated in basal part, up to 3 or more times as long as wide, cell walls thinner, not much thickened in corners, less pitted, cuticle less roughened. Dioicous: antheridia numerous in a terminal disk-shaped inflorescence, paraphyses numer-

ous, longer than antheridia, yellow, clavate with broad rounded terminal cell; archegonia not seen; capsule as yet unknown. Type locality, Norway.

ILLUSTRATIONS:—Bry. Eur. pl. 400; Ark. f. Bot. 21A, No. 1: f. 49, 50; Pl. 108.

In moist places about rocks, distribution more northern than for the preceding species: the only American specimens seen which were correctly named were collected by Berggren in Greenland and by Williams in the Yukon; also in Europe (Scandinavia) and reported from Spitzbergen and Siberia. I have included this as a separate species as I have not been able to confirm with certainty Dixon's view (Rev. Bryol. 36: 33f. 1909) that it is not distinct from *M. hymenophylloides*. The packet sent me by Dixon (from Swedish Lapland) contains both species, showing that they evidently grew together in the same locality, but the separate tufts appear in every case to be referable to one or the other of the two species, though approximating each other more than is usually the case. Archegonial plants have been reported only from a single locality, in Siberia, and from the description (Lindb. & Arnell, Musc. Bor. Asiae 2: 15f. 1890) would seem to differ from those of *M. hymenophylloides*, in fact to be rather unique among the *Mniaceae*. With capsules unknown there is nothing to place this species in *Cinclidium*: its gametophyte characters show no very close relation to the known species of that genus.

## 2. CINCLIDIUM Sw. Schrad. Bot. Journ. 1: 25. 1801.

Not differing from *Mnium* in its gametophyte characters. All species have entire bordered leaves. The capsule differs in its peristome: the exostome having shorter blunt teeth, the endostome not divided as normally into segments and cilia, but consisting of a single dome-like structure with small round opening at apex and somewhat irregular openings at the side, corresponding in number and position with the outer peristome teeth. Spores rather large. Type species, *Cinclidium stygium* Sw.

This genus, consisting of a few closely related species mostly of far northern distribution, is doubtless more closely akin to *Mnium punctatum* and *M. cincidioides* than to other *Mnium* species, but I see no adequate reason either to eliminate the genus *Cinclidium* or to break up the genus *Mnium*.

### KEY.

1. Synoicous.....	2.
Dioicous.....	3.
2. Leaves obovate, sharply apiculate.....	1. <i>stygium</i> .
Leaves obovate-spatulate with blunt apex.....	3. <i>subrotundum</i> .
3. Leaves oval, narrow for the genus.....	4. <i>arcticum</i> .
Leaves generally broader than long, edges strongly reflexed.....	2. <i>latifolium</i> .

### 1. CINCLIDIUM STYGIUM Sw. Schrad. Journ. Bot. 1: 27, pl. 2. 1801.

*Meesia stygia* Brid. Musc. Rec. 2: 172. 1803.

*Amblyodium stygium* Pal. de Beauv. Prodri. 41. 1805.

*Mnium stygium* Br. & Sch. Bry. Eur. fasc. 5: 17, pl. 385. 1838.

*Cinclidium Macounii* Kindb. Rev. Bryol. 23: 21. 1896.

Plants in independent tufts or frequently much intermixed with various other swamp mosses, 3 cm. high or sometimes considerably higher, reddish brown or greenish in young growth to nearly black in lower parts, much matted below with dark brown radicles; stems stout, erect, simple or occasionally branching subapically, dark brown, pentagonal in section with central strand; leaves of good size, rather few and distant, closer toward summit where they form, in case of fertile plants, a rosette, spreading, considerably crisped and distorted when dry, from a very narrow base broadly oval to obovate, sharply apiculate, with a reddish border of 3 or 4 rows of very narrow thick-walled cells; costa strong, reddish, generally extending into apex, in section with single stereid band; cells of leaf, except those immediately adjacent to costa or border, elongated in oblique or transverse direction from costa to border, irregularly elongated-hexagonal, up to  $50 \times 30 \mu$ , rather thick-walled without thickened corners, *walls pitted*. Synoicous, paraphyses slightly yellowish, long and slenderly clavate, terminal cell somewhat rounded and broader than those below. Seta slender, erect, flexuose, 3 or 4 cm. long or sometimes longer, reddish yellow, thickened and strongly crooked where it passes into neck of capsule; capsules frequent, single, pendulous, up to 4 mm. long, oval-pyriform with prominent broad neck about  $1/3$  length of entire capsule, light yellowish brown when mature; operculum hemispherical; annulus present; exothelial cells thin-walled, small, tending to be hexagonal and hardly elongated, smaller, thicker-walled, darker-pigmented and somewhat flattened in 4 or 5 rows at mouth of

capsule; stomata in neck of capsule, cryptopore; outer peristome teeth light greenish yellow, *short, broad and blunt or even irregularly emarginate at apex*, somewhat bordered and irregular in contour at sides, minutely papillose, dorsal divisural line zig-zag, dorsal plates high and few, lamellae few; inner peristome darker, yellowish brown in color, minutely roughened, columns supporting the dome (which would correspond to segments in normal peristome) slender, carinate without openings at keel; spores varying in size even in same capsule, up to  $50 \mu$  or more, the smaller ones of half this diameter or less, greenish yellow, roughened, ripening in summer. Type locality, Sweden.

ILLUSTRATIONS:—Swartz, I. c.; Bry. Eur. *pl. 385*; Braithw. Brit. Moss Fl. **2**: *pl. 83D*; Ark. Bot. **21A**, No. **1**: *f. 41, 42*; M. H. M. *pl. 5, f. 14; Pl. 106*.

EXSICCATI:—Drumm. Musc. Am. *272*; Holz. Musc. Acro. Bor. Am. *297*.

In very wet swampy places or bogs; of northern distribution, found recently in 2 localities in Michigan and may yet be found elsewhere in our northern tier of states, occasional northward to Yukon and Alaska, Labrador and Greenland; also in Europe. The other species are all closely related to *C. stygium*, but I have found no reason to deny them specific validity. Most of the American material in herbaria is either clearly or probably referable to *C. stygium*, even in some cases that found under other names.

**2. CINCLIDIUM LATIFOLIUM** Lindb. Bot. Notiser (1877): 43.

Differs from the preceding in its strongly arcuate-recurved leaves whose edges are so strongly recurved as to give the leaf a dorsally concave or even saccate form, when flattened out showing a broadly ovate or transverse oval shape with greater width than length, short apiculate, leaf-cells decidedly lengthened in oblique or transverse direction, up to  $90 \times 30 \mu$ , not very thick-walled. Dioicous: antheridial head large and disk-shaped, elevated on a thick stem, with few small distant leaves below and a few large broad perigonial ones; both antheridia and paraphyses very numerous, the antheridia brown, the paraphyses brownish yellow, slightly longer than the antheridia, clavate, terminal cell rounded; capsules occasional, the one imperfect one seen was smaller, on a shorter slender seta (2 cm.) with a short thick neck. Type locality, Siberia.

ILLUSTRATION:—Ark. Bot. **21A**, No. **1**: *f. 43, 44; Pl. 107*.

A characteristic specimen was recently sent me, rightly named, by Dr. Steere, from a collection made during the summer of 1938 by Père Dutilly (No. 6308) in northern Canada. It has also been recorded recently from Vansittart Island in the Arctic by Hesselbo (Report of the 5th Thule Expedition 1921-24, **2**, No. **2**: **16**, 1935). Otherwise known only from the original collections in Siberia and reported as fossil in glacial deposits in Denmark.

**3. CINCLIDIUM SUBROTUNDUM** Lindb. Not. Soc. Faun. Flor. Fenn. Förh. **9**: 72. 1868.

Differs from *C. stygium* in leaves broadly obovate-spatulate, strongly bordered, rounded or even emarginate in apical part, with a short, broad, blunt point which may or may not be entered by the costa. Capsule shorter and broader with short neck; outer peristome-teeth much longer and gradually narrowed upward, though blunt or irregular at apex, the lamellae tending to be somewhat retuse and the upper part of teeth sometimes with round perforations or partial perforations along median line, teeth not bordered but quite irregular in contour; stomata in neck not numerous, slightly cryptopore. Syncious and frequently bearing capsules, which mature in summer. Type locality, northern Scandinavia.

ILLUSTRATIONS:—Ark. Bot. **21A**, No. **1**: *f. 45, 46; Pl. 107*.

In cold, wet, swampy places, of still more northern distribution than *C. stygium*. Arctic America from Greenland to the Yukon. In Europe confined to northern Scandinavia and Finland; also in Spitzbergen and Siberia.

**4. CINCLIDIUM ARCTICUM** (Br. & Sch.) C. Muell. Syn. **1**: 154. 1848.

*Mnium arcticum* Br. & Sch. Bry. Eur. fasc. **31**: 1. *pl. 386*. 1846.

Plants generally growing in pure or nearly pure tufts, up to 6 cm. deep, densely matted with brown radicles, reddish brown; stems erect, simple or occasionally branching, brown, pentagonal in section with central strand; leaves somewhat distant, erect, undulate when dry, brownish pigmented, narrower than in other species, oval with acute or slightly apiculate apex, decurrent, border revolute, brown, of 2 or 3 rows of narrow cells; costa very strong, percurrent; cells of leaf mostly not elongated in transverse direction, irregularly hexagonal, smaller than in other species, not often more than  $35 \mu$  in diameter, walls fairly thick and much pitted, corners not thickened. Dioicous: antheridial plants often growing with others and cap-

sules produced (none seen from American stations); antheridia in a large terminal disk-shaped head with few spreading perigonal leaves which are much like others in shape and size; antheridia brown, papaphyses extremely numerous, brownish yellow, considerably longer than the antheridia, narrowly clavate, terminal cell rounded, generally not exceeding in diameter the 3 or 4 cells below it. Seta slender, erect, flexuose, 2-4 cm. in length, red or reddish; capsules single, pendulous, brown, oblong, about 3 mm. in length, with narrower neck; peristome much as in *C. stygium*, outer teeth slightly longer, columns supporting dome of inner peristome irregular in contour and tending to be somewhat slit along keel; capsules ripening in summer. Type locality, Norway.

ILLUSTRATIONS:—*Bry. Eur. pl. 386*; *Ark. Bot. 21A*, No. 1: f. 47, 48; *Pl. 108*.

A plant of the far north. One of the Fram Expedition collections (No. 3229 from Renbugten, King Oscars Land) shows a purely archegonial inflorescence and agrees otherwise with the species. From the Fram Expedition collections Bryhn attempted (Report of the Second Norwegian Expedition in the Fram, No. 11: 118. 1906) to separate another species *C. polare* (Kindb.) (*C. arcticum* subsp. *polare* Kindb. from Spitzbergen, Europ. and No. Amer. Bryineae 322. 1897). Of 3 specimens under this name which I have seen 2 (Nos. 2082 and 3714), both from King Oscars Land, may well be *C. arcticum*; I find no inflorescence at all and the latter specimen is so poorly developed as to be practically unidentifiable. The 3rd specimen (No. 394 from Ellesmere Land) is *Bryum tortifolium* Funck. As Lindberg once noted, completely sterile specimens of *C. stygium* may easily be taken for *C. arcticum*. The latter species is also known from Scandinavia, Spitzbergen and Siberia.

#### Family RHIZOGONIACEAE

By A. LE ROY ANDREWS

Small and slender to tall and robust plants, simple to much branched, often matted with a dense growth of smooth or nearly smooth rhizoids; stem erect, in section with central strand. Leaves of various shapes, sometimes with a strongly toothed border; costa strong, in the large species with central guide-cells and 2 stereid-bands; cells of leaf mostly small and thick-walled, not elongated. Capsule on erect seta, of various positions, forms and conditions of peristome, the latter in the fully developed forms double, with outer teeth, inner segments and cilia; stomata in neck of capsule, phaneropore. Inflorescence on a short bud-like branch with much differentiated leaves, either nestled in the basal rhizoids or attached higher up the stem. Paraphyses filiform.

A small family, pretty much confined to the tropics and the southern hemisphere, of which a single species reaches our Gulf states; growing on bark or decaying wood or sometimes on other substrata. Though commonly placed in proximity to the Mniaceae, its relationship to the latter family is problematical, certainly no very close one; it is more or less pleurocarpous.

#### 1. RHIZOGONIUM Brid. *Bry. Univ. 2: 663. 1827.*

*Rhizopelma* C. Muell. *Bot. Zeit. 5: 803. 1847.*

*Pyrrhobryum* Mitt. *Journ. Linn. Soc. Bot. 10: 174. 1868.*

Small and delicate to tall and robust plants, generally in more or less loose tufts; leaves bi- or trifarious to uniformly spreading, mostly long and narrowly lanceolate in robust forms, in others shorter and broader, prominently toothed, teeth double in some species; costa strong, sometimes toothed dorsally in upper part, in section with 2 stereid-bands; cells of leaf-blade thick-walled, small, quadrilateral to hexagonal. Dioicous, autoicous or synoicous, inflorescence subbasal or lateral. Sporogonia single, but perichaetia sometimes closely grouped; seta erect, long; capsule normally curved; operculum more or less beaked; annulus present. Peristome double, complete, inner with non-appendiculate cilia; spores small. Type species, *R. Novae-Hollandiae* Brid.

If the genus is divided, the robust species with narrow spreading leaves, including our species, would come under Mitten's genus *Pyrrhobryum*. Mitten himself withdrew this genus shortly after proposing it.

#### RHIZOGONIUM SPINIFORME (L.) Bruch, *Flora 29: 134. 1846.*

*Hypnum spinaeforme* L. *Sp. Pl. 1122. 1753.*

*Mnium spiniforme* C. Muell. *Syn. 1: 175. 1848.*

Plants in independent loose tufts or somewhat intermingled with other mosses, generally 3 or 4 cm. high, sometimes higher, yellowish green, matted with brown radicles in lower part; stems slender, usually

simple, tending to be erect, but often variously curved, brown, pentagonal in section with central strand; leaves numerous, but somewhat distant, spreading in all directions from stem when moist, somewhat incurved when dry, narrowly elongated-lanceolate, not decurrent, gradually long-acuminate, border thickened, with numerous double teeth, its cells not otherwise different from others of leaf blade; costa strong, yellowish, percurrent, toothed dorsally in upper part of leaf, in section with median guide-cells, 2 stereid-bands and enlarged ventral and dorsal cells; cells of leaf rounded, with thickened non-pitted walls, somewhat irregular in size and shape, generally small, up to  $18\ \mu$  in diameter. Syncious and quite commonly fruiting, said to be sometimes autoious, inflorescence in small bud-like branches after the manner of the pleurocarps, springing from the basal part of the stem among the brown tomentum, sometimes a number grouped together, the perichaetial leaves ovate, passing somewhat abruptly into a long toothed acumination, yellowish in color, the teeth single, the cells of leaf blade narrow and elongated, costa strong, excurrent; antheridia and archegonia fairly numerous, paraphyses numerous, yellowish-hyaline, long-filiform. Seta slender, up to 5 or more cm. in length, erect but often variously curved, reddish below, yellowish above; capsule yellowish brown, clavate, curved to a sub-horizontal position, narrowing gradually into a short neck, about 3 mm. long when deoperculate; operculum obliquely beaked; annulus present; exothecial cells small, thick-walled, tending to be somewhat irregularly rectangular, elongated to twice or more as long as wide and arranged in rather definite longitudinal series, gradually shortened in as many as 8 or 10 rows at mouth of capsule, which are also somewhat darker-pigmented; stomata in neck of capsule, phaneropore; outer peristome teeth brownish-yellow, gradually narrowed to apex, very close at base, where they appear as if coalesced, bordered throughout, the dorsal longitudinal divisural line somewhat zig-zag, the dorsal plates definitely striped, ventral lamellae close and numerous, but not prominently projecting; inner peristome fragile, very light yellow, of about equal length with outer teeth, its basal membrane very high, segments narrow, slightly if at all slit along keel, cilia generally 2, slender, slightly nodulose, sometimes cohering; spores about  $18\ \mu$ , brownish, papillose. Type locality, Jamaica.

ILLUSTRATIONS:—Bryol. Javanica, pl. 131, 132; Hedw. Stirp. Crypt. 3: pl. 25; Bartram, Hawaiian Mosses f. 83; Pl. 109.

EXSICCATA:—Aust. Musc. Appal. 516; Holz. Musc. Acro. Bor. Am. 174; R. & C. Musc. Am. Sept. 64; Grout, Musc. Perf. 168; Bauer, Musc. Eur. et Amer. Exsiccati. 2030.

Widely spread and common through the tropics and subtropics of the whole world, growing especially on decayed wood and humus. Not uncommon in our southern states from Georgia and Florida to Louisiana.

### ADDITIONAL NOTES ON THE BRYACEAE TREATED IN VOLUME II, PART 3

*Mielichhoferia Mielichhoferiana* (Funck) Limpr. A poorly developed sterile tuft was picked out of a collection of other mosses from Roxbury Notch, Maine (1939) and recognized, apparently correctly, by Mr. J. C. Parlin as belonging to this species.

*Mielichhoferia macrocarpa* (Drumm.) Br. & Sch. Add to the synonyms *Bryum Nelsonii* Kindb. Rev. Bryol. 36: 98. 1909. Type from Gunnison, Colorado seen. New localities have recently been reported by Bartram from the Aleutian Islands, Alaska.

*Orthodontium pellucens* (Hook.) Br. & Sch. This species was recognized in sterile material sent by Sharp from Sevier County, Tennessee (1937). The collector has already reported and discussed its occurrence in this locality.

*Pohlia crudoides* (Sull. & Lesq.) Broth. A good specimen with capsules not fully ripe was sent me by Steere from material collected by N. Polunin at Wolstenholme, Quebec, Aug. 1, 1936.

*Pohlia cruda* (L.) Lindb. Since Part 3 was printed material of this species has come to my attention from several localities in Virginia, North Carolina and Tennessee, always in the small sterile form.

*Pohlia sphagnicola* (Br. & Sch.) Lindb. & Arn. Another specimen of Canadian Cryptogams 48 from Kingston, Nova Scotia, showed clearly a separate antheridial head, confirming the identification of Kindberg. Add also to its synonymy *Bryum leptodictyon* Philib., Proc. Wash. Acad. Sc. 4: 320, pl. 18, f. 3, (1902) from Alaska.

*Pohlia Schimperi* (C. M.) Andrews. Good specimens of this species had been collected years ago by Grout in the Great Gulf of the White Mts. of New Hampshire.

*Pohlia cucullata* (Schwaegr.) Bruch. Add as synonym *Bryum oxoniense* Dixon, Bryologist 32: 2. 1929 from West Greenland.

*Pohlia Drummondii* (C. M.) Andrews. Add to the synonyms of this species *Bryum compactum* Aust. Bot. Gaz. 2: 111. 1877 and *Mielichhoferia ? compacta* Aust. Musc. Appal. Suppl. No. 509. 1890 and *Bryum pertenellum* Bryhn & Ryan, Rep. 2nd Norw. Arct. Exped. Fram, No. 11: 101. 1906. I was apparently wrong in stating that Holzinger's Exsiccati number 143b, collected by Grout at Mt. Mansfield,

Vermont, was not *P. Drummondii*. Grout succeeded in finding his undistributed material a single capsule, which places the material clearly in this species and at the same time provides the key to the identity of the similar sterile material of Austin, distributed as *Mielichhoferia ? compacta*. The occurrence of *P. Drummondii* in the mountains of northern New England is then fully established. Specimens have also been seen from Maine.

*Pohlia prolifera* Lindb. Grout found a small amount of what seems to represent this species in Newfane, Vermont and has already reported it.

*Pohlia carneae* (L.) Lindb. Specimens have been seen from Ohio (Bartley & Pontins) and from Iowa (Miss G. Sayre).

*Pohlia filiformis* (Dicks.) Andrews. Its distribution may be extended eastward in the United States to Maine (Mrs. Merle Adams).

*Brachymenium systylium* (C. M.) Jaeg. This has been sent from three different localities in Florida, two by Miss R. O. Schornherst, one by Grout. All are without fruit.

*Brachymenium Wrightii* (Sull.) Broth. It has long been assumed that this was the species found years ago at several localities in Florida. In my treatment I unfortunately failed to deal critically enough with this assumption. The Florida material which I have examined is quite uniform and does not agree so well with the West Indian *B. Wrightii* as for example with the Mexican *B. macrocarpum* Card., the following description of which with accompanying illustration should then be substituted for that of *B. Wrightii*.

BRACHYMENIUM MACROCARPUM Card. Rev. Bryol. 38: 6. 1911.

Plants loosely tufted or sometimes more scattered among other bryophytes, 1.5 cm. or less in height, green to brownish, densely matted below with purplish radicles; stems more or less erect, mostly simple; leaves not large, closely arranged on stem, erect-spreading when moist, spirally twisted when dry, concave, obovate, cuspidate with the projecting costa, reflexed at margin nearly to apex, serrulate toward apex; costa strong, yellowish green, excurrent in a toothed, reflexed not hyaline point; cells of leaf blade with thin non-pitted walls, roughly hexagonal in upper part of leaf, up to  $55 \times 25 \mu$ , becoming square in basal part, bordered by 1 or 2 rows of narrow cells in upper part, the border dissolving below. Dioicous, but commonly fruiting, antheridia not seen. Seta slender, flexuose, usually less than 2 cm. high, reddish brown; capsule erect, ovate to ovate-cylindrical, generally broadest near the base, small at mouth, deoperculate about 3 mm. long, light tan-color, neck very short, operculum conical, darker in color; annulus present; exothelial cells irregular, thin-walled, gradually shortened toward mouth of capsule, the last 8 rows small, flattened and darker pigmented, stomata in neck, phaneropore; outer peristome-teeth dark brown, slender, extremely papillose; inner peristome yellow, papillose, with segments partially developed; spores brownish, papillose, about  $15 \mu$ . Type locality, Zazuapan, state of Vera Crua, Mexico (leg. Purpus, 1907).

ILLUSTRATION:—Pl. 98A.

On trees, rocks, etc. Mexico to Florida. The key to *Brachymenium* needs change only in the second line to read instead of "Leaves spreading, crispate when dry," "Leaves erect-spreading, spirally twisted when dry."

## PART 5

### APPENDIX TO VOLUME II

By A. J. GROUT

#### ARTIFICIAL KEY TO *POHLIA* BASED ON LEAF CHARACTERS

Only one species has margined leaves, most have acute and serrate leaves and the costa varies in length in many species even on the same plant. For the length of costa the upper leaves should be studied.

As in *Grimmia* and *Orlíotrichum*, completely sterile plants are often practically indeterminable.

Species marked \* are arctic alpine only; those marked † are not found east of the Rocky Mts.

- 1. Leaves plainly bordered; costa ending below apex..... †26. *Tozeri*.  
Leaves not bordered; costa various..... 2.
- 2. Leaves mostly obtuse to subobtuse, nearly or quite entire..... 3.  
Leaves acute to acuminate (see *Cardoti*)..... 5.
- 3. Margins plane or nearly so (narrowly reflexed and leaves often acute in *Drummondii*)  
Margins strongly reflexed ..... 4.
- 4. Leaves decurrent; capsules erect..... †2. *Cardoti*.  
Leaves not decurrent, very concave; capsules pendent..... †1. *defecta*.
- 5. Costa ending below the apex in most leaves..... 27. *filiformis*.  
Costa percurrent to excurrent..... 6.
- 6. Margins somewhat revolute..... 15.  
Margins plane..... 7.
- 7. Leaves not decurrent..... 9.  
Leaves decurrent..... 21. *atropurpurea*.
- 8. Plants large, up to 3 cm.; leaf cells relatively broad, up to  $20 \times 70 \mu$ ..... 8.  
Plants smaller, up to 1 cm.; leaf cells up to  $15 \times 70 \mu$ ..... \*12. *Ludwigii*.
- 9. Dry mature deoperculate capsules (spore case) about as wide as long or wider;  
stomata cryptopore..... 13. *Drummondii*.  
Dry capsules clearly longer than wide..... 10.
- 10. Plants rarely over 1 cm. high; leaves not decurrent; very rare..... 11.  
Plants normally over 1 cm., often up to 5 cm.; leaves decurrent; frequent..... 23. *carnea*.
- 11. Leaves large with a metallic luster, yellowish or whitish..... 24. *Wahlenbergii*.  
Leaves not as above, without metallic luster..... 12.
- 12. Plants yellowish; capsule with a long neck..... 13.  
Plants whitish; neck of capsule short and not well differentiated..... 4. *longicolla*.
- 13. Paroicous..... 5. *cruda*.  
Diocious..... \*11. *cucullata*.
- 14. Plants usually with bulbils in some leaf axils..... 14.  
Plants without axillary bulbils..... †14. *gracilis*.
- 15. Leaf margins plane (slightly reflexed in *bulbifera*)..... \*9. *sphagnicola*.  
Leaf margins more or less revolute..... 16.
- 16. Propagula infrequent, purplish plants of Florida and the tropics..... 18.  
Propagula numerous, yellowish; plants typically northern..... 28. *Cruegeri*.
- 17. Bulbils (gemmae) 1-3 per leaf axil, with blunt leaf-like lobes..... 17.  
Bulbils 2-5 per leaf axil, lobes acute..... 16. *bulbifera*.
- 18. Plants mostly without gemmae..... 18. *annotina*.  
Plants with usually abundant gemmae..... 19.
- 19. Neck of the capsule as long as the spore case or longer..... 28.  
Neck of capsule not longer than spore case..... 7. *elongata*.
- 20.

20. Capsule decidedly longer than broad when dry and empty; (see *longibracteata*) . . . . .  
 Capsule (spore case) at least as broad as long when dry and empty . . . . .

21. Arctic-alpine; rare . . . . .  
 Very common, especially in elevated regions . . . . .

22. Capsules erect to horizontal; arctic only . . . . .  
 Capsules horizontal to pendent . . . . .

23. Plants 1-2 cm. high, green; cilia of peristome lacking . . . . .  
 Plants up to 5 cm.; stem and costa often red; cilia present, nodulose . . . . .

24. Stem and costa not red . . . . .  
 Stem and costa mostly red . . . . .

25. Leaves strongly serrate . . . . .  
 Leaves entire or slightly toothed . . . . .

26. Median leaf cells up to  $15 \times 70 \mu$  . . . . .  
 Median leaf cells up to  $7 \times 85-100 \mu$  . . . . .

27. Leaves not decurrent . . . . .  
 Leaves strongly decurrent . . . . .

28. Gemmae large, red and single in leaf axils . . . . .  
 Gemmae smaller, not red, several in each leaf axil . . . . .

29. Plants tall, with broad leaves, yellowish green with luster; gemmae elongated and  
 numerous in upper leaf axils only, irregular, with one, or at most, two leaf  
 points . . . . .  
 Leaves narrower, green, without luster; gemmae varying from ovoid to elongate  
 and twisted, with several leaf points . . . . .

21.  
 24.  
 22.  
 8. *nutans*.  
 \* 3. *crudioides*.  
 23.  
 6. *acuminata*.  
 \* 10. *Schimpéri*.  
 25.  
 26.  
 †25. *longibracteata*.  
 19. *pulchella*.  
 21. *atropurpurea*.  
 27.  
 †20. *vexans*.  
 22. *columbica*.  
 15. *Rothii*.  
 29.  
 17. *prolignera*.  
 18. *annotina*.

## ARTIFICIAL KEY TO BRYUM \*†

1. Leaves obtuse; costa ending at or below leaf apex (*crassirameum* and *teres* may be  
 sought here) . . . . .  
 Leaves acute to long-acuminate (*Muhlenbeckii* and *gemmae* may be sought  
 here) . . . . .

2. Leaves somewhat decurrent . . . . .  
 Leaves not decurrent . . . . .

3. Leaf cells thin-walled, up to  $35 \times 20 \mu$ ; costa ending well below leaf apex . . . . .  
 Leaf cells thick-walled or thickened at the corners . . . . .

4. Plants light colored, without red or brown pigmentation; calciphile . . . . .  
 Plants dark colored, red or brown; not calciphile . . . . .

5. Leaves not bordered, margins plane . . . . .  
 Leaves bordered, margins more or less revolute . . . . .

6. Plants small, up to 3 mm. (4-10 mm. in European plants); capsules obovoid to  
 short-pyriform, up to 2.5 mm. . . . .  
 Plants robust, up to 5 cm.; capsules clavate, up to 5 mm. . . . .

7. Upper median leaf cells  $50 \times 25 \mu$  . . . . .  
 Upper median leaf cells up to  $70 \times 20 \mu$  (rare western) . . . . .

8. Costa ending below apex in most leaves . . . . .  
 Costa percurrent to long-excurrent . . . . .

9. Plants silvery white, a common weed in dry places . . . . .  
 Plants green, sometimes colored with red and brown . . . . .

10. Leaves strongly long-decurrent . . . . .  
 Leaves slightly or not at all decurrent . . . . .

11. All parts very large; leaf cells exceeding  $100 \mu$  in length . . . . .  
 Plants smaller; leaf cells not over  $50 \mu$  in length . . . . .

2.  
 8.  
 3.  
 5.  
 18. *tortifolium*.  
 4.  
 30. *gemmae*.  
 29. *Muhlenbeckii*.  
 6.  
 7.  
 32. *Blindi*.  
 †27. *miniatum*.  
 \* 11. *calophyllum*.  
 3. *Marratii*.  
 9.  
 13.  
 34. *argenteum*.  
 10.  
 17. *Weigelii*.  
 11.  
 †38. *Sandbergii*.  
 12.

Species marked \* are found only in arctic America or the high Rockies. Those marked † have not been found east of the Rockies.

12. Leaf margin strongly reflexed; cilia of inner peristome lacking.....  
 Leaf margin not reflexed; cilia present.....

13. Costa long excurrent, especially in the uppermost leaves (*inclinatum* and *coronatum* may be sought here).....  
 Costa percurrent to shortly excurrent.....

14. Outer peristome teeth with ventral lamellae extensively joined by cross-walls;  
 segments adherent, cilia lacking.....  
 Outer peristome teeth not as above; segments not normally adherent (somewhat  
 so occasionally in *arcticum*).....

15. Cilia of inner peristome rudimentary or lacking; plants of the arctic only.....  
 Cilia well developed, usually appendiculate.....

16. Leaf cells with walls somewhat thickened, not pitted.....  
 Leaf cells thin-walled, often somewhat pitted.....

17. Leaf cells very narrow, about  $70 \times 10 \mu$ ; dioicous, capsules up to 4 mm. long.....  
 Leaf cells  $3-5 : 1$ , rarely above  $60 \mu$  long.....

18. Normally dioicous, occasionally monoicous; capsules subcylindric, up to 5 mm.  
 long.....  
 Monoicous or autoicous; capsules pyriform to obovoid.....

19. Leaves lanceolate; capsules up to 5 mm. long; western.....  
 Leaves ovate-lanceolate to ovate.....

19a. Autoicous; rare in the east.....  
 Monoicous; common.....

20. Capsules short and broad, subglobose to ovoid-pyriform; inner peristome a low  
 membrane only.....  
 Capsules pyriform, oblong or oblong-cylindric; inner peristome with well devel-  
 oped segments.....

21. Leaves not plainly bordered, marginal cells often longer and narrower.....  
 Leaves plainly bordered by well differentiated long narrow cells (*turbinatum* may  
 be sought here).....

22. Plants silvery in color.....  
 Plants green, sometimes tinged with brown or red.....

23. Leaf margins plane or reflexed at base only.....  
 Leaf margins reflexed or revolute at least  $\frac{2}{3}$  the length.....

24. Leaves scarcely decurrent; capsules symmetric, broadly pyriform.....  
 Leaves decurrent; capsules mostly somewhat curved, clavate.....

25. Leaf cells up to  $70 \mu$  long, narrow and elongated,  $6-7 : 1$ .....  
 Leaf cells up to  $50 \mu$  long,  $2-3 : 1$ .....

26. Leaf cells thick-walled, up to  $35 \times 15 \mu$ ; plants widely distributed.....  
 Leaf cell lax, thin-walled; tropical, and in Florida.....

27. Inner peristome with cilia rudimentary or lacking (arctic except *cernuum* and *in-  
 clinatum*); (occasional specimens of *Biddlecomiae* and *pallens* may lack cilia).  
 Inner peristome with well developed cilia.....

28. Costa mainly excurrent.....  
 Costa only occasionally excurrent.....

29. Margins not revolute.....  
 Margins strongly revolute.....

30. Seta up to 8-10 cm. long; base of peristome teeth with conspicuous fundus.....  
 Seta not over 6 cm. long; peristome teeth without fundus.....

31. Leaf cells lax and thin-walled.....  
 Leaf cells moderately thick-walled, thickened at the corners.....

32. Plants dioicous; capsules with a long neck, curved.....  
 Plants monoicous; capsules short, symmetric.....

33. Outer peristome teeth slender below, without ventral longitudinal groove.....  
 Outer peristome teeth broad below, with ventral longitudinal groove.....

\*2. *brachyneuron*.  
 \*20. *teres*.  
 14.  
 20.  
 4. *pendulum*.  
 15.  
 16.  
 17.  
 \*7. *archangelicum*.  
 \*9. *arcticum*.  
 24. *caespiticium*.  
 18.  
 †36. *canariense*.  
 19.  
 21. *cirratum*.  
 19a.  
 23. *pallescens*.  
 22. *cuspidatum*.  
 \*1. *Wrightii*.  
 21.  
 22.  
 27.  
 34. *B. argenteum lanatum* (P. B.) Bry. Eur.  
 23.  
 24.  
 25.  
 †16. *turbinatum*.  
 35. *capillare*.  
 28. *alpinum*.  
 26.  
 31. *bicolor*.  
 33. *coronatum*.  
 28.  
 34.  
 29.  
 32.  
 13. *cernuum*.  
 30.  
 \*6. *longisetum*.  
 31.  
 \*10. *purpurascens*.  
 5. *inclinatum*.  
 \*15. *oeneum*.  
 33.  
 \*8. *lacustre*.  
 \*12. *acutum*.

34. Monoicous . . . . .	35.
Dioicous . . . . .	38.
35. Outer peristome teeth light yellow . . . . .	†13a. <i>Biddlecomiae</i> .
Outer peristome teeth dark or brownish yellow, at least at base . . . . .	36.
36. Small (1-2 cm.) arctic plants; leaf cells up to $30 \times 15 \mu$ . . . . .	*19. <i>nitidulum</i> .
More robust plants of wider distribution; leaf cells $35-50 \mu$ in length . . . . .	37.
37. Synoicous, occasionally dioicous; usually reddish, common . . . . .	25. <i>bimum</i> .
Autoicous; red color less prominent; rare in the eastern U. S. . . . .	23. <i>pallescens</i> .
38. Peristome teeth light yellow; capsule curved with neck as long as rest of capsule . . . . .	14. <i>pallens</i> .
Peristome teeth dark yellow, at least at base . . . . .	39.
39. Neck shorter than the rest of the capsule . . . . .	†37. <i>truncorum</i> .
Neck nearly or quite as long as the rest of the capsule . . . . .	40.
40. Leaves tending to be imbricate when dry: capsule usually red . . . . .	†26. <i>crassirameum</i> .
Leaves contorted and not imbricate when dry; capsules brown . . . . .	25. <i>bimum</i> .

Many Europeans prefer to use *Webera* instead of *Pohlia*, for reasons which do not seem valid to me. *Webera* was first used for *Webera sessilis* in 1779, Hann. Mag. 257 (*Diphyscium foliosum*). *Webera* has often been used for *Diphyscium* in recent times (Braithwaite for instance), thus tending to confusion. *Webera* was first used by Hedwig in 1782 (Fund. 2: 95) for two species of *Bartramia* which are cited first and a *W. trichodes* which has been referred to *W. nutans* by Hedwig, Sp. Musc. 168. 1801. But on p. 171 he uses *Pohlia* for *P. elongata*. Thus giving *Webera*, already used for another genus, the priority of three pages !!! *Pohlia* was first used by Hedwig for *P. elongata* St. Crypt. 1: 96. pl. 36.

For those who wish to follow the 1930 rules agreed upon unanimously by the International Botanical Congress at Cambridge the following changes in the citation of names of the Bryaceae and Mniaceae should be made:

*Leptobryum pyriforme* (Hedw.) Schimp. (*Webera pyriformis* Hedw. Sp. Musc. 179.)  
*Pohlia longicolla* (Hedw.) Lindb.  
*Pohlia cruda* (Hedw.) Lindb. (*Mnium crudum* Hedw. Sp. Musc. 189.)  
*Pohlia nutans* (Hedw.) Lindb.  
*Pohlia delicatula* (Hedw.) n. comb. (*Bryum delicatulum* Sp. Musc. 179) for *P. carneae*.  
*Plagiobryum Zierii* (Hedw.) Lindb. (*Pohlia Zieri* Hedw. Sp. Musc. 182.)  
*Bryum angustirete* Kindb. for *B. pendulum*.  
*Bryum inclinatum* (Web. & Mohr.) Sturm.  
*Bryum uliginosum* (Brid.) Bry. Eur. fasc. 6-9: pl. 339. 1839, for *B. cernuum* (Sw.) Lindb. (*Pohlia uliginosa* Brid. Bryol. Univ. 841. 1826.)  
*Bryum pallens* (Web. & Mohr.) Roehl. Deutsch. Fl. 3: 96. 1813.  
*Bryum caespiticium* Hedw. Sp. Musc. 180. 1801.  
*Bryum pseudotriquetrum* (Hedw.) Schwaegr. Suppl. 12: 110. 1816, for *B. bimum* (*Mnium pseudotriquetrum* Hedw. Sp. Musc. 190).  
*Bryum alpinum* Brid. Musc. Recent. 2<sup>3</sup>: 30. 1803.  
*Bryum argenteum* Hedw. Sp. Musc. 181. 1801.  
*Bryum capillare* Hedw. Sp. Musc. 182.  
*Rhodobryum roseum* (Bry. Eur.) Limpr. (*Bryum roseum* Bry. Eur. fasc. 6-9: pl. 365. 1839.)  
*Mnium stellare* Hedw. Sp. Musc. 191.  
*Mnium hornum* Hedw. Sp. Musc. 188.  
*Mnium serratum* Brid. Musc. Recent. 2<sup>3</sup>: 84. 1803, for *M. marginatum*.  
*Mnium cuspidatum* Hedw.  
*Mnium rostratum* Roehl. Deutsch. Fl. 3: 96. 1813.  
*Mnium punctatum* Hedw. Sp. Musc. 193. 1801.

#### Family RHACOPILACEAE

Plants distinctly pleurocarpous; prostrate stems radiculose; leaves dimorphous, the larger lateral leaves in two rows, strongly contorted when dry, asymmetrical; dorsal leaves much smaller in two rows

resembling amphigastria; costa strong, usually excurrent. Seta elongate; capsule inclined, striate when dry; peristome double, hypnoid; operculum beaked; calyptora cucullate, hairy.

RHACOPILUM P. Beauv. Prodr. 36. 1805.

Plants with the characters of the family. We have but one species.

RHACOPILUM TOMENTOSUM (Hedw.) Brid. Bryol. Univ. 719. 1827.

*Hypnum tomentosum* Hedw. Stirp. Crypt. 4: 48. pl. 19. 1797; Sp. Musc. 240. 1801.

*Hypnum tomentosum* Sw. Prod. Fl. Ind. Occid. 141. 1788.

*Hypnum mucronatum* P. Beauv. l. c. 66.

*Rhacopilum mnioides* P. Beauv. l. c. 87.

Plants dark green; stems creeping, freely branching when fully developed, radiculose, with branches erect; leaves strongly contorted when dry, smaller near the ends of stem or branches; lateral leaves 1-2 mm. long and about half as broad, slightly decurrent; costa excurrent into a subulate apiculus; margins unevenly and rather coarsely serrate above the middle; smaller dorsal leaves triangular-lanceolate with the excurrent part of the costa nearly as long as the rest of the leaf; median leaf cells hexagonal, rather longer than broad, 8-12  $\mu$  wide, often with minute papillae. Monoicous; perichaetal leaves smaller and long-subulate; seta stout, red, 2-3 cm. long; capsule oblong-cylindric, about 5 mm. long, somewhat curved, ribbed and contracted under the mouth when dry and empty; peristome double, the outer of 16 brown teeth with paler papillose tips; inner peristome pale, papillose with well developed segments; split along the keel; cilia shorter, nodose to appendiculate; operculum conic-rostrate; annulus narrow, dehiscent; spores 13-16  $\mu$ , smooth. Type locality "Hispaniola," O. Schwartz. "on roots of trees." On roots of trees, decaying wood and humus. Louisiana (*Mohr*), Florida (*Grout & McFarlin*).

The Florida plants were small and inconspicuous and very little in quantity; they remind one of *Fissidens* at first sight, due to the complanate leaves.

ILLUSTRATIONS.—Engler & Prantl, Naturl. Pflanzen f. (Ed. 2) 11: f. 470; Bryol. 10; pl. 5; Pl. 110.

ADDITIONS AND CORRECTIONS

ENTOSTHODON WIGGINSII Steere, Bryol. 41: 36. 1938.

"Autoicous. Plants apparently perennial by innovations, densely gregarious, bright yellowish-green; stems short, 2-5 mm. high, red, strongly radiculose at the base, little branched; leaves much crowded at the apex of the stem, lacking below, shriveled and distorted when dry, erect-spreading when moist, obovate to oblong-spathulate, always widest above the middle, 2.0 to 3.0 mm. long, 0.7 to 1.2 mm. wide, rather concave, acute, sometimes apiculate, or rarely short acuminate; leaf margin entire below, sinuose with slightly projecting cells at the middle and rather bluntly serrate by projecting cells in the upper half, often very slightly inflexed on one or both sides near the apex; costa strong, green, ending not far below the apex, although never percurrent; leaf cells at base very flaccid, lacking chlorophyll, rectangular, four or five times as long as wide, above soon becoming hexagonal-oblong, those in the marginal row somewhat narrower and very slightly longer than the others but never conspicuously differentiated as a border. The male flower terminal on a short branch from the base of the plant. Inner perichaetal leaves smaller; seta bright red below, somewhat paler above, erect or very slightly curved, never flexuose, 5-7 mm. long, capsule pale when young, brown when old, 1.5-2.0 mm. high, erect and symmetric, pyriform to elongate-pyriform, hardly shrunken below the straight, wide mouth, tapering to an irregularly sulcate and somewhat inflated neck or collum which is fully as long as the spore-sac; cells of the exothecium linear and very thick walled, epidermis of collum strongly stomatose; lid plano-convex, not at all apiculate even when dry; annulus completely absent; peristome appearing single, although traces of a hyaline, fugaceous inner peristome, which is usually destroyed by the shrinking of the columella, are sometimes present; teeth 230-250  $\mu$  long, bright red, arranged obliquely on a hyaline membrane inserted well below the mouth, very irregular in outline and often perforated along the median line, vertically and obliquely striate below, vertically and obliquely papillose-striate above, and papillose at the paler apex, articulations 7-8, median zig-zag line inconspicuous;

spores produced in early spring, dark brown, roughly and irregularly verrucose-granulose on the outer face, hyaline and completely smooth on the inner, attached surface, 20-24  $\mu$  in diameter, persisting to a large extent as tetrads 32-36  $\mu$  in diameter; calyptra inflated-cucullate, long-rostrate, very pale yellow, deeply split on one side." "TYPE: On fine soil in crevices of rocks at base of cliffs at tanks nine miles southwest of Stoval, Yuma County, Arizona, N. E. side of Mohawk Mountains, March 1, 1937, Ira L. Wiggins, No. 8646A (Type in Herbarium of the University of Michigan)."

"Persistence of the spores of *E. Wigginsii* in tetrads is a unique condition in the genus, and separates this species from all its congeners, as well as from nearly all other members of the Musci. In its other characteristics *E. Wigginsii* belongs to the complex series of species which inhabit the dry American southwest, of which four species are endemic to Arizona. The species which are most nearly related to *E. Wigginsii*, and which otherwise closely resemble it, differ as follows: (1) *E. Bartramii* Grout in the wider cells of the leaf-margin, the shorter seta, the conic operculum, and the nearly smooth spores; (2) *E. Bolanderi* Lesq. in the entire or only crenulate, filiform-acuminate leaves, longer seta and conic operculum; (3) *E. rubrisepta* (Bartr.) Grout in the pellucid hair point, longer seta, and especially in the curved asymmetric capsule, the conical operculum and nearly smooth spores; (4) *E. plano-convexa* (Bartr.) Grout in the filiform-acuminate leaf with shorter basal cells, more highly developed peristome and only faintly granulose spores; (5) *E. Tucsonii* (Bartr.) Grout in the less serrate leaves, conic operculum, very rudimentary, pale yellow peristome and much larger spores; (6) *E. sonorae* (Card.) n. comb. (*Funaria sonorae* Card., *Revue Bryol.* 36: 110, 1909) in the less serrate leaves, shorter seta and conic operculum." *Pl. III.*

*SPLACHNOBRYUM KIENERI* Williams, *Bryol.* 38. 92. *pl. 5.* 1935.

"Plants sterile, growing in compact cushions with very slender stems and 2-3 erect branches, up to 2 cm. high, bearing a few scattered radicles and flagella; the stems in cross section pentagonal, about 0.2 mm. in diameter, showing cortical cells with slightly thickened walls in one layer, the ground tissue of large irregular cells and a scarcely distinct central strand; the leaves of the branches distant below, closer and imbricate upward, about 1 mm. long, from almost rotund to oblong with incurved apex acute to broadly rounded, all very concave with flat, entire borders; costa at base about 40  $\mu$  wide, pale, extending upward from near the middle of leaf to within 5 or 6 cells of the apex, in cross section showing a small stereid band of one row of 3 or 4 cells, a single row of larger dorsal cells and 2 large ventral cells; median and upper cells of leaf slightly convex on both surfaces; the marginal cells at apex of leaf not crenulate, mostly 2 or 3 times longer than wide with the longer side forming the margin; median cells of leaf quite irregular, more or less rhomboidal with thin walls, the basal becoming rectangular with no distinct alar group." Type locality, "by stream where intermittently submerged, at Boulderfield on Long's Peak, Colorado, at 12,500 ft. alt., by Walter Kiener, Aug. 31, 1932, no. 1443." *Pl. III.*

"This plant seems distinct from all other American species in the not crenulate margin of apical cells with border cells on either side of middle apical cell much elongate; the leaves also are more concave, imbricate and broader."

P. 19. The plicae in the leaves of *Grimmia cilirosa* often do not show in young leaves. These are rather dorsal bands of thickening cells with the appearance of secondary nerves [Dixon, *Handb.* (Ed. 3) 168].

P. 20. *G. cilirosa* Hedw. has been collected at Roxbury, Maine, by Mrs. C. D. Adams.

P. 27. *G. Doniana*, N. Carolina (Anderson).

P. 41. *G. Hartmani* var. *anomala*, Huron Mts., Michigan.

P. 47. *Campylostelium siccicola*, Ohio.

P. 54. *Rhacomitrium aquaticum*, Woodland, Ulster Co., N. Y. (Catskill Mts.) (Haring).

P. 54. *Rhacomitrium brevisetum* Lindb. *Contr. ad Flor. Crypt. As. Bor. Or.* 244. 1872. This was reported from Ellesmere Land lat. 79 degrees north by Dr. Nils Bryhn in the Report of the Second Norwegian Expedition in the Fram (1898-1902).

P. 62. Key to *Grimmia* C, no. 11, line 2 add: if arcuate, shorter than the capsules. To line 1 add: longer than the capsule.

P. 67. 4th line from the bottom, M. H. M. f. 64, not 67.

P. 68. *Ephemerum intermedium* Mitt. *Braithw. Brit. Moss. Fl.* 2: 184. *pl. 27C.* 1884. Differs from *E. serratum* in having a costa in the upper part of the leaf, occupying the greater part of the apex but vanishing before the middle of the leaf; upper leaf cells narrower. Tennessee (Sharp).

As the costa is very thin and faint, recognizable chiefly by the deeper green color, this evidently is best regarded as a variety of *serratum*, which is illustrated by M. H. M. f. 64, not 67.

- P. 68. *Ephemerum cohaerens*, New Orleans (*Penfound*).
- P. 69. *E. crassinervium*, Wisconsin (*Cheney*).
- P. 70. *E. spinulosum* var. *hystrix*, Tennessee (*Sharp*).
- P. 71. Latin description of var. *floridanum*, 1 x 0.3, not 1.03.
- P. 73. *Physcomitrella*, not *Physcomitriella*.
- P. 74. In the Key *pygmaeum* should be numbered 5 and *Kellermani* 3.
- P. 77. *Physcomitrium Hookeri* should be numbered 6 and *P. coloradense* 7, and on P. 78 *P. immersum* should be numbered 8.

In the *Bryologist* 40: 81, Dr. Flowers tells of collecting *Physcomitrium pygmaeum* in good condition. He states that while some capsules were immersed many had longer setae up to 11 mm.

- P. 79. Line 2, read *rubrisetus* for *rubisetus*.
- P. 80. No. 5, third line from the bottom should read *Entosthodon planoconvexus* as on p. 78.
- P. 84. Next to last line of key, no. 7 should read *Muhlenbergii*, not *calcarea*.

**FUNARIA POLARIS** Bryhn, Rept. 2nd Norwegian Arctic Expd. in the Fram, 70. 1907.

Plants cespitose, small, yellow-green; stems short, up to 5 mm., blackish, radiculose below; leaves little changed in drying, difficult to soften, erect open when moist, the lower few and small, corolla crowded into a dense head, carinate-concave, ovate-lanceolate, acutely acuminate, acumen subrecurved; margins plane, not bordered and entire, about 1.5 wide and about twice as long; costa thin, smooth, vanishing in the apex; leaf cells hexagonal-rectangular, hexagonal at apex, basal laxer, rectangular, empty; all cells smooth. Autoicous. Seta slender, up to 2 cm. long, arcuate at summit, pale yellow, brown with age; capsule inclined to pendent, erect with age, subsymmetric, pyriform, with neck 2.5 x 1 mm., with neck as long as the spore case, lightly striate, yellow, brown with age; annulus large, of three rows of cells easily revoluble, purple; peristome inserted well below capsule mouth, about 0.3 mm. long, lance-subulate, densely lamellate with high lamellae, brownish yellow, hyaline at apex, densely papillose; operculum conic, cells spirally arranged, purple at the margin; spores 15  $\mu$ , smooth. Type from King Oscar Land.

A fine species nearest *F. aequidens* Lindb. and *F. kashmirensis* Broth. but sufficiently distinct as described. Translated from the original. Specimens not seen but the species is accepted by Brotherus, Engler & Prantl, *Naturl. Pflanzenfam.* (Ed. 2) 10: 331.

- P. 90. Last line of no. 5 in key to genera, *Splachnum* should read *Splachnum*.
- P. 107. No. 34 should drop the last i. No. 35 and in description of plate 55, *parvum* instead of *parvulum*.
- P. 111. *Douglasii*, not *Douglassii*, line 9. Line 18, *Roellii*, not *Roelli*.
- P. 115. The capsules of *Orthotrichum sordidum* are often more emergent with shorter neck than is indicated in the description. Miss Wickes collected this species on rocks in Alleghany State Park, N. Y.
- P. 116. Line 24, *Breutelii*, not *Breuteli*.
- P. 117. The capsules of *O. elegans* are sometimes slightly plicate when old and dry.
- P. 123. *O. strangulatum* was collected on sandstone in the Rocky Mt. National Park by Walter Kiener. Several cases are known to the author where calcicolous species were found on other than limestone substrata. Such substrata should be tested for alkalinity, especially lime compounds.
- P. 125. The peristome teeth in *O. alpestre* var. *occidentale* are erect at first, later reflexed. This variety is occasionally found on bark of trees.
- P. 128. Fourth line from bottom, *Garrettii*, not *Garretti*. Strangely enough this species has been collected in Ohio near Columbus by Leslie Pontius.
- P. 140. *Anoectangium canadense* Kindb. Ottawa Nat. 14: 86. 1900 is a synonym of *Amphidium californicum*.
- P. 144. According to Dr. A. J. Sharp, *Macromitrium paraphysatum* Mitt. Jour. Linn. Soc. 12: 198. 1869 is another synonym of *M. Sullivantii*. He has seen the type of *M. paraphysatum*. Dr. Anderson reports *M. Sullivantii* from High Falls, N. Carolina.
- Dr. Sharp has seen the type of *M. didymodon* Schwaegr. Suppl. 2: 138. pl. 190. 1827 and states that it is the same as *M. rhabdocarpum* Mitt. Thus it becomes the name for the species. *M. tenellum* Card. Rev. Bryol. 36: 109. 1909, is another synonym according to Dr. Sharp.

P. 154. *Conostomum boreale* Swartz should be *C. tetragonum* (Hedw.) Lindb. *Mnium tetragonum* Hedw. Sp. Musc. 73. 1801.

P. 157. *Bartramia Oederi* Brid. Musc. Recent. 2<sup>3</sup>: 135, not 136.

P. 158. Most specimens of *Bartramia pomiformis* have the leaves more or less crisped when dry (see key).

P. 174. Eighth line, *Philonotis fontana* (Hedw.) Brid.

P. 205. *Pohlia filiformis* var. *concinna* n. comb.

Leaves acute, costa percurrent. Occasional in elevated regions.

## ADDITIONS AND CORRECTIONS TO VOLUME I.

P. 19. *Fissidens taxifolius* is illustrated by *Plate 8*, not 10.

*F. osmundioides* was collected by Small at Tallulah Falls, Georgia.

P. 52. *Blindia acuta*, North Carolina and Tennessee (Sharp).

P. 75. Some of the plants of *Arctoa fulvella* collected on Mt. Washington, N. H., last August were so different from the general run of that species, which is frequent there above 5000 ft., that it seemed they should be differentiated as var. *Anderssonii* (Wich.) n. comb. (name incorrectly spelled on p. 75). The capsule was completely immersed.

P. 101. *Atrichum crispum*, Iowa (Conard).

P. 127. ILLUSTRATIONS: Jennings, *pl. 29*, not 19.

PP. 158, 159. *Gymnostomum calcareum* and *G. tenuie* are also illustrated in *Pl. 123*.

P. 211. 4th line from bottom, plane, not plain.

P. 217 and 218. Peristomes of *Crossidium aberrans*, *C. desertorum* and *C. erosum* are illustrated in Vol. II, *Pl. 112*.

P. 220. *Husnoiella Pringlei*, Oklahoma, in quantity (Sharp).

P. 250. The illustration of *Campylopus caroliniae* is in Vol. II, *Pl. 112*.

PP. 252, 253. *Ditrichum curvirostrum* and *Fissidens Andersoni* are illustrated in Vol. II, *Pl. 115*.

SYRRHOPODON PROLIFER Schwaegr. Suppl. 2<sup>2</sup>: pt. 2. 99. *pl. 180*. 1827.

*S. flavescens* C. Muell. Syn. 1: 541. 1849.

*S. parvulus* Schimp. C. Muell. Syn. 1: 544. 1849.

*S. Schwanckianus* C. Muell. Bot. Zeit. 13: 763. 1855.

*S. scaber* Mitt. Jour. Linn. Soc. 12: 119. 1869.

*S. calymperidianus* Besch. Ann. Sci. Nat. VI. 3: 19. 1876.

*S. subviridis* Besch. l. c. 196.

*S. scaber* var. *breviligulatus* C. Muell. Hedwigia 37: 235. 1898.

*S. breviligulatus* C. Muell. Gen. Musc. 370. 1901.

*S. Dussii* Broth. Symb. Ant. 3: 422. 1903.

(The synonymy is that of Williams, Bull. Torr. Club, 47: 376. 1920, except that Mr. E. B. Bartram is the authority for the synonymy of *S. prolifer*.)

"Dioicous: in compact yellowish brown to pale green cushions with branching stems, mostly 1-2 cm. high, bearing radicles at their base and often at the base of easily separating branches; stem leaves when dry erect-spreading, flexuous, 5-12 mm. long, with an oblong-linear base 1-1.5 mm. long, rather gradually narrowed to a linear point three to eight times longer and about  $\frac{1}{3}$  as wide as the base, with cylindric, yellowish or hyaline border extending all around and entire except at the acute or somewhat rounded, dentate apex; costa not quite percurrent, more or less spiny-dentate near the apex on both sides, in cross-section showing four to eight guide-cells with stereid bands above and below, the outer cells on upper side and usually two or three outer cells next guide cells on either side below, differentiated; leaf cells rather thickened, often slightly elongate, about  $6 \times 6 \mu$  to  $8 \times 10 \mu$ , with thickened, minutely papillose walls on both surfaces; cancellae ending above in narrowly acute angles, or sometimes somewhat obtuse, nearly filling the leaf base; perichaetial leaves scarcely differing from upper stem-leaves; seta slender, erect, red, 5-8 mm. long; capsule oblong-cylindric, scarcely 1.5 mm. long, with rostrate lid about 1 mm. long; peristome teeth lanceolate, yellowish, papillose, projecting above the mouth about  $100 \mu$ , with often indistinct articulations; spores minutely roughened, about  $12 \mu$  in diameter; calyptra extending  $\frac{2}{3}$  down capsule, somewhat rough at apex." (Quoted from Williams, l. c.) Type locality, Trinidad.

ILLUSTRATION:—*Pl. 113A.*

Throughout the West Indies and Brazil to Mexico; Alum Bluff, moist banks of steep ravine, Liberty Co., Florida (sterile), Ruth Olive Schornherst. The identification has been checked by Mr. Bartram and Dr. William C. Steere.

In a dry state the whitish, bristle-like leaves are entirely unlike any of the other Florida Syrrhopodons.

## DIDYMODON HINCKLEYI Bartr. Bryol. 43: 96, figs. 1-10. 1940.

"Autoicous, male buds axillary below the perichaetium. Small plants in dense cushions, bright green above, brownish below, without lustre. Stems simple or branched, to 1 cm. high, with a distinct central strand. Leaves crowded, 2 mm. long, suberect and strongly contorted when dry, spreading when moist, narrowly lingulate from an oblong, concave base, rounded or bluntly pointed at the apex, carinate above, entire; margin usually narrowly recurved on one side near mid-leaf; costa ending well below the apex, in cross section showing narrow bands of stereid cells on both sides of the median guide row below and a dorsal band only in the upper half of the leaf; basal cells rectangular, hyaline, thin-walled, to 18  $\mu$  wide, upper cells oval or subrectangular and rounded, smooth, to 18  $\mu$  long, smaller and bistratose at the margins, chlorophyllose and incrassate. Seta pale, erect, 4-5 mm. long; capsule narrowly oblong-cylindric, erect, urn 1.25 mm. long; peristome teeth 16, inserted below the rim, about 30  $\mu$  wide below, entire, weakly papillose, rounded or truncate at the tips; annulus broad and persistent; spores smooth, 10-12  $\mu$ . Operculum and calyptra not seen." *Pl. 115.*

Texas: Madera Canyon, Mt. Livermore, July 20, 1937, L. C. Hinckley no. 1131, 1135, 1142 type.

This singular and interesting little moss seems to be nearer *Didymodon tophaceus* than anything else but differs widely in the autoicous inflorescence, the bistratose marginal cells of the leaf blade and the broad, entire peristome teeth. The costal structure showing both dorsal and ventral stereid bands precludes *Desmatodon* while *Gyroweisia* is supposed to be characterized by plane-margined leaves, a homogeneous costa and stems without a central strand.

## DESMATODON BARBULA (Schwaegr.) n. comb.

*Gymnostomum Barbula* Schwaegr. Suppl. 2<sup>o</sup>: pt. 1. 77. *pl. 175.* 1826.

*Hyophila Barbula* Hampe, Bot. Zeit. 1846: 267. 1846.

*Pottia Barbula* C. Muell. Syn. 1: 558. 1849.

*Weisia Barbula* Mitt. Jour. Linn. Soc. 12: 135. 1869.

*Tortula melanocarpa* Mitt. l. c. 20: 60. 1877.

*Gyroweisia cubensis* Broth. Engler & Prantl, Natur. Pflanzenf. (Ed. 1) 389. 1902.

*Gyroweisia Barbula* (Schwaegr.) Paris, Index (Ed. 2) 2: 299. 1904.

Plants very small, gregarious; stems scarcely 1 mm. long, rarely branching, densely foliate; leaves contorted to subcrispate when dry, spreading when moist, linear-ligulate, rather abruptly rounded-obtuse, more rarely obtusely-acute, carinate, reaching 2 x 0.3 mm., entire but slightly crenulate by the bulging marginal cells, unistratose throughout; margins plane; costa mostly dorsal, covered on the ventral side with cells similar to those of the lamina, in cross section with only a dorsal stereid band, with guide cells just below the ventral cells; upper leaf cells bulging-mamillose especially on ventral surface, subglobular when fresh, without papillae, rather thick-walled, 10-15  $\mu$  in diameter, rounded but of somewhat unequal dimensions; basal cells hyaline, rectangular to hexagono-rectangular at base, these hyaline cells shorter above and extending farther up the margin than next the costa; perichaetial leaves usually a little smaller, scarcely sheathing. Dioicous; vaginule bulbous; seta red, lighter above, 5-10 mm. long, erect; calyptra tubular-conic, cucullate; capsule cylindric-oblong, erect and symmetric or nearly so, urn 2-3 mm. long; operculum about  $\frac{1}{2}$  the length of the urn, rostrate, erect; annulus large; peristome teeth narrowly joined at base, linear, up to 0.25 mm. long, irregularly divided to perforate between the joints, strongly papillose; stomata in the base of the capsule; exothelial cells linear except at the urn mouth; spores smooth, about 8  $\mu$ , mature in-late autumn. Type locality, Cuba. *Pl. 114.*

EXSICCATI:—Wright, Cuban Mosses 13 (as *Pottia Barbula*).

On limestone, Wakulla Springs, Florida (Schornherst); also reported from Florida in Paris, Index Bryol. (Ed. 2), but without other data. Apparently common in the West Indies.

The type of *Barbula melanocarpa* has been examined. There seems to be absolutely no characters to separate this from *Desmatodon*. *Gyroweisia* as generally treated seems to be a highly synthetic genus.

## ADDITIONS AND CORRECTIONS TO VOL. III.

As Vol. III, pt. 1, was published before the Cambridge Congress the following changes in citation should be made.

*Brachythecium albicans* (Hedw.) Bry. Eur.

*B. flagellare* (Hedw.) Jennings [*B. plumosum* (Sw.) Bry. Eur.]

Var. *homomallum* (Bry. Eur.) Jennings.

Var. *Pringlei* (Williams) Grout.

Var. *Roellii* (Ren. & Card.) Grout.

*B. salebrosum* (Web. & Mohr.) Bry. Eur.

*Cirriphyllum piliferum* (Hedw.) Grout.

*Eurhynchium Stokesii* (Turn.) Bry. Eur. (*E. praelongum*).

P. 23. *Eurhynchium Brittoniae* is illustrated in Vol. I, *Pl. 125B*.

P. 28. *Chamberlainia biventrosa* is illustrated in Vol. I, *Pl. 126B*.

P. 34. *Brachythecium roteanum* is illustrated in Vol. I, *Pl. 126A*.

P. 37. *B. glareosum* occurs in Labrador (Wickes); Kamloops, British Columbia (Brinkman).

P. 37. *B. Wootonii* is illustrated in Vol. I, *Pl. 127A*.

P. 38. *B. edentatum* is illustrated in Vol. I, *Pl. 125A*.

P. 47. *B. Leibergii* is illustrated in Vol. I, *Pl. 128A*.

P. 49. *B. Bolanderi* is illustrated in Vol. I, *Pl. 126C*.

P. 53. *Scleropodium apocladum* is illustrated in Vol. I, *Pl. 124A*.

P. 55. *S. californicum* is illustrated in Vol. I, *Pl. 125C*.

P. 264. *Bryhnia Hultenii* is illustrated in Vol. I, *Pl. 128B*.

P. 87. *Hygrohypnum luridum* (Hedw.) Jennings, Mosses, W. Pa. 287. 1913, for *H. palustre* (Huds.) Loeske. Hedw. Sp. Musc. gives *Hypnum palustre* as a synonym only.

P. 110. Through the kindness of the Oslo Museum I have been able to examine a specimen of the *Hypnum (Drepanocladus) pseudorufescens* Warnst. from West Greenland, Egdesminde, lat. 69° which was reported in the Report of the Second Norwegian Expedition in the Fram. To me this seems better treated as a *pseudofluitans* form of *Drepanocladus aduncus* var. *Kneifii*.

P. 131. *Hypnum hamulosum* Labrador (Wickes).

P. 137 and index. *Heterophyllum*, not *Heterophyllum*.

P. 191. In the key, no. 2, line 2 "costa smooth" does not always fit *L. obscura*.

P. 242. *Fontinalis disticha*, N. Carolina (Wetherby); Michigan (Ehlers).

P. 258. *Brachelyma subulatum*, Holmes Co., Florida (J. B. McFarlin).

P. 207. Mr. Bartram identifies our Florida *Callicostella* as *C. pallida* (Hornschr.) Jaeg. & Sauerb. because Mitten, Jour. Linn. Soc. 12: 353 classes *C. scabriseta* as dioicous with smooth cells. The Florida plant like *C. pallida* is autoicous with papillose cells. Hooker in his original description of *C. scabrida* does not mention either character. Brotherus in Engler & Prantl, Naturl. Pflanzenf. (Ed. 2). 11: 229, has apparently copied Mitten. Mr. Dixon has examined the types of both species and finds Mr. Bartram correct.

## PLAGIOTHECIUM MARIANNAE n. sp.

Plantae in tegetibus tenuibus supra calcem; caules 5 cm. longi, prope prostrati; folia 2.5 x 0.9-1.2 cm., distincte complanata, inequalia, ovata vel ovata-lanceolata, angusta ad basin, sensim in apicem tenuissimum producta; in axilis foliorum paraphyllia similia foliis minutis.

Plants growing in rather thin loose mats over limestone, bright to dark green; stems up to 5 cm. long, irregularly branching, nearly prostrate, radiculose ventrally in the older portions; leaves erect-spreading both wet and dry, up to 2.5 x 1.2 mm., but mostly less than 1 mm. in breadth, distinctly complanata, often slightly unsymmetric, ovate to broadly ovate-lanceolate, narrowed to the insertion in a rather gradual curve with insertion scarcely  $\frac{1}{2}$  the greatest width of the leaf, gradually filiform acuminate, entire to serrulate above; costa short and faint or lacking; clusters of small leaf-like paraphyllia frequent in the leaf axils; leaf cells linear, up to 100  $\mu$  or more in length, 8-10  $\mu$  in width, shorter and broader near the base, at the insertion next the stem a row or two of short subinflated cells that usually remain attached to the stem when the leaf is removed. Apparently dioicous as plants with numerous archegonial buds showed no

antheridia. Type from near Marianna Caves, Jackson Co., Florida, Nov. 16, 1939 (A. J. Grout & Ruth Olive Schornherst). *Pl. 113.*

By reason of the axillary paraphyllia this is placed in the subgenus *Taxiphyllum*, although the leaf outline is unusual for this group.

LINDBERGIA MEXICANA (Besch.) Card. Rev. Bryol. 37: 51. 1870.

*Leskea Mexicana* Besch. Prodr. Bryol. Mexic. 80. 1871.

*Haplohymentum densum* Schimp. in Besch. Prod. Bryol. Mex. 89. 1871. (Not *Leskea densa* Hook. 1822.)

Plants slender, dark green, irregularly to subpinnately branching; stems 1-2 cm. long, julaceous; leaves appressed-imbricate when dry, widely spreading when moist, ovate to ovate-lanceolate, entire, acute to acuminate, narrowed to the insertion, not decurrent, up to 1 mm. long, mostly longer; costa strong, ending just below the apex; alar cells transversely elongate, subrectangular,  $\pm 7 \mu$  in longest dimension, smaller at the margin, basal cells near the costa not transversely elongate; upper median cells rather irregular, rectangular, oval or subrhomboidal, rather thick-walled, smooth or somewhat bulging, those on ventral surface of costa somewhat elongated below, less so near apex; leaf-like paraphyllia sparingly present; perichaetial leaves sheathing at base, long-acuminate, cells linear-oblong. Seta straight and erect, up to 8 mm. long; capsules erect and symmetric, urn up to 2.5 mm. long including the short neck; operculum conic; peristome teeth strongly papillose narrow and short (up to 0.2 mm. long); inner peristome a low membrane or lacking; spores up to  $13 \mu$ , minutely roughened. Type locality, Mexico. *Pl. 114, f. 1-6.*

Madre Canyon, Mt. Livermore, Texas (L. C. Hinckley) no. 1132. Det. & comm. E. B. Bartram.

The leaves of Hinckley's specimen are narrower, ovate-lanceolate, and more slenderly acuminate than those of the Mexican plants collected by Bro. Arsène, no. 1810, Rancho Santa Barbara, vicinity of Puebla, State of Puebla, Det. Thériot.

PLATE 84. *Bryum pendulum* (from Braithw. Brit. Moss Fl. 2: *pl. 70*). a, plants  $\times 1$ ; a\*, sterile plant magnified; 1, leaf and portion of margin magnified; 5, capsules; 6, calyptra; 8, portion of peristome.

*Bryum Marratii* (from the same plate and with the same explanation).

A. *Bryum Biddlecomiae* (Drawings by Flowers). 1, plants  $\times 3$ ; 2, plant with slender branches  $\times 10$ ; 3, typical lax leaf  $\times 20$ ; 4, another leaf  $\times 20$ ; 5, upper lax leaf  $\times 20$ ; 6, flagellate branch leaf  $\times 20$ ; 7, apex of typical lax leaf  $\times 200$ ; 8, median leaf margin  $\times 200$ , the cells inside the margin are too thick-walled; 9, capsule  $\times 13$ .

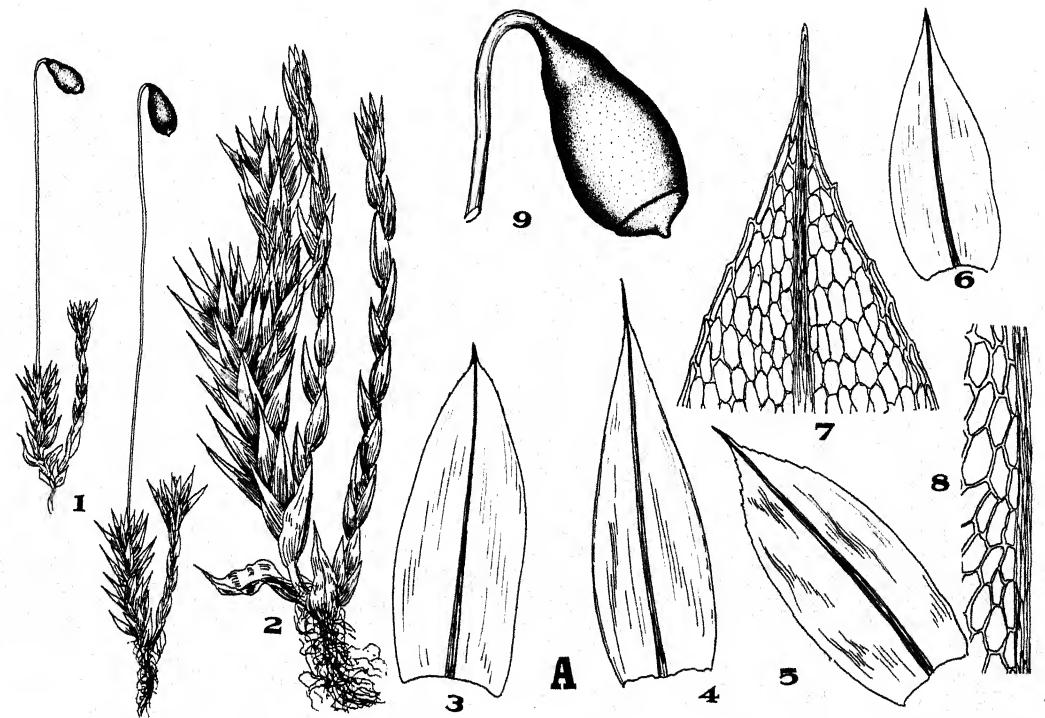
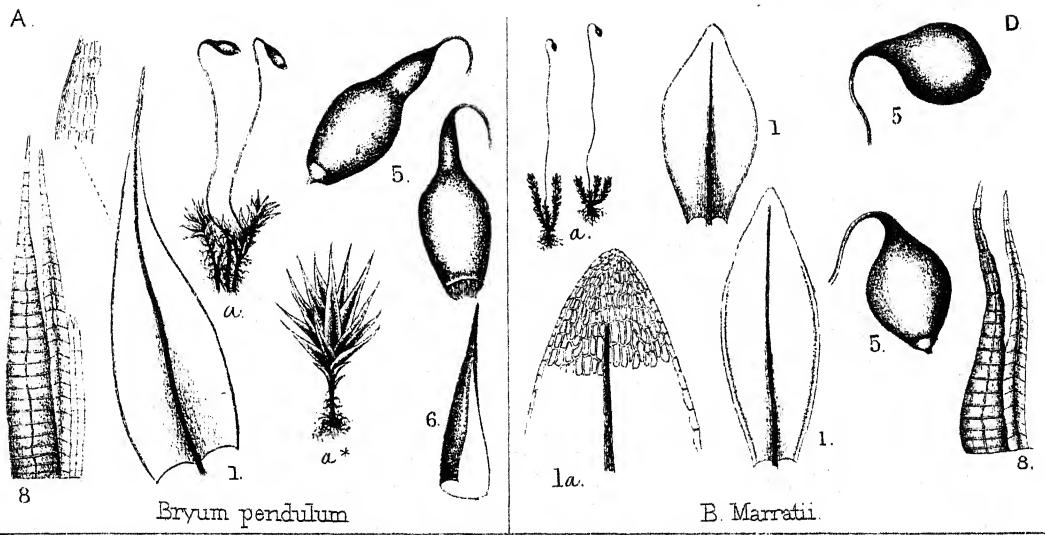


PLATE LXXXIV

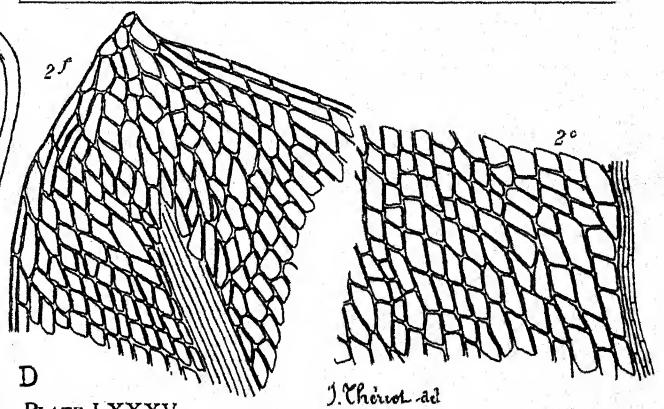
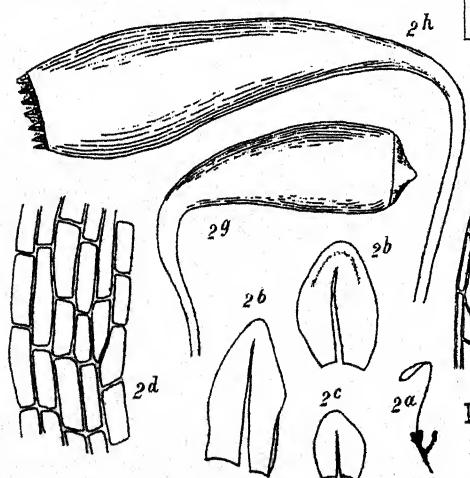
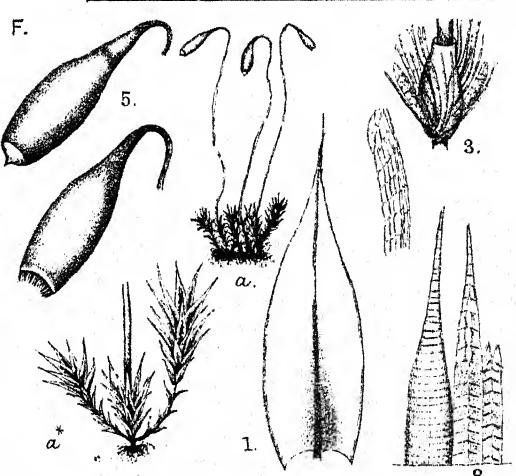
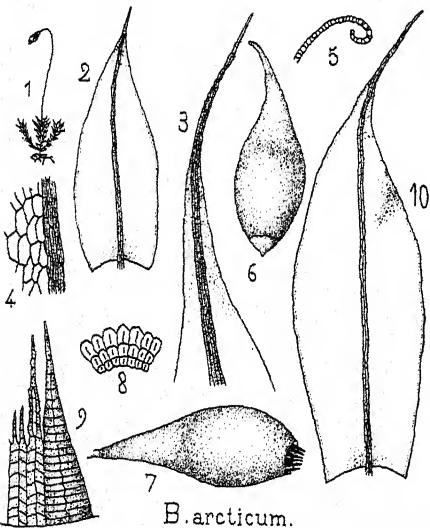
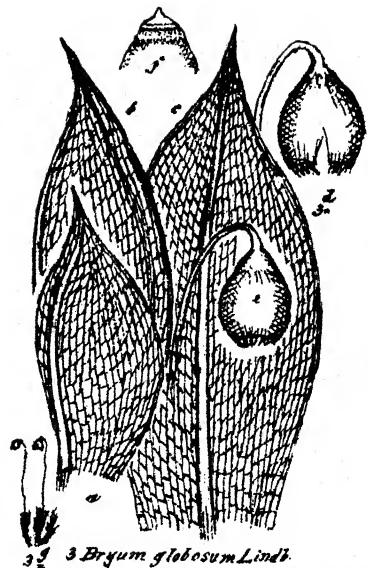
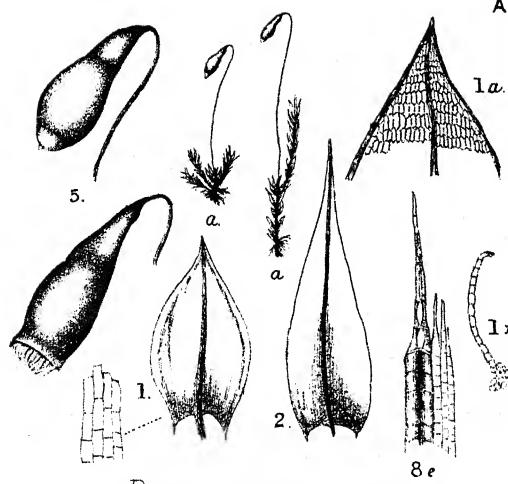
PLATE 85. *Bryum purpurascens* (from Braithw. Brit. Moss Fl. 2: pl. 72).

*Bryum inclinatum* (from Braithw. l. c. pl. 69). Description of each; a, plants  $\times 1$ ; a\*, plant enlarged; 1, leaf; 2, outer perichaetal leaf; 1x, portion of cross section of leaf; 1a, portion of leaf showing areolation; 3, base of seta showing vaginule, antheridia and paraphyses; 5, capsules; 8, part of peristome; 8e, part of inner peristome.

*Bryum arcticum* (from Husnot, Musc. Gall. pl. 63). 1, plant  $\times 1$ ; 2, leaf; 3, leaf apex more enlarged; 4, marginal leaf cells; 5, portion of cross section of leaf showing revolute margin; 6, 7, capsules; 8, annulus; 9, portion of peristome; 10, leaf of var. *helveticum* (Philib.).

*Bryum Wrightii* (as *B. globosum*) (from Roth, Eur. Laubm. pl. 20). g, plants  $\times 1$ ; a, b, c, leaves; d, e, capsules; j, operculum in place.

D. *Bryum brachyneuron* Kindb. (*B. agattuense* Philib.) (from Proc. Wash. Acad. Sci. 4: pl. 20). 2a, plant  $\times 1$ ; 2b, stem leaves  $\times 13$ ; 2c, branch leaf  $\times 13$ ; 2d, basal leaf cells  $\times 135$ ; 2e, median leaf cells  $\times 135$ ; 2f, leaf cells of apex  $\times 135$ ; 2g, immature capsule  $\times 13$ ; 2h, ripe and deoperculate capsule  $\times 13$ .



D PLATE LXXXV

J. Chenu ad

PLATE 86. *A. Bryum archangelicum*. 1, portion of peristome  $\times 200$ ; 2, inner face of a tooth  $\times 200$ ; 3, detail of inner lamellae of tooth  $\times 400$ .

*B. Bryum nitidulum*. 1, plant  $\times 3$ ; 2, portion of stem  $\times 7$ ; 3, leaves  $\times 20$ ; 4, apex of leaf  $\times 200$ ; 5, median marginal cells  $\times 200$ ; 6, capsule  $\times 13$ .

*D. Bryum Wrightii*. 1, plants much reduced; 2, plant  $\times 13$ ; 2', base of seta and perichaetial leaf; 3, leaves; 4, upper leaves; 5, leaf apex; 6, basal cells; 7, capsules. (All drawn by Seville Flowers; *D* copied from original drawings by Sullivant from the type, loaned by the Farlow Herbarium of Harvard University. These drawings were without scale.)

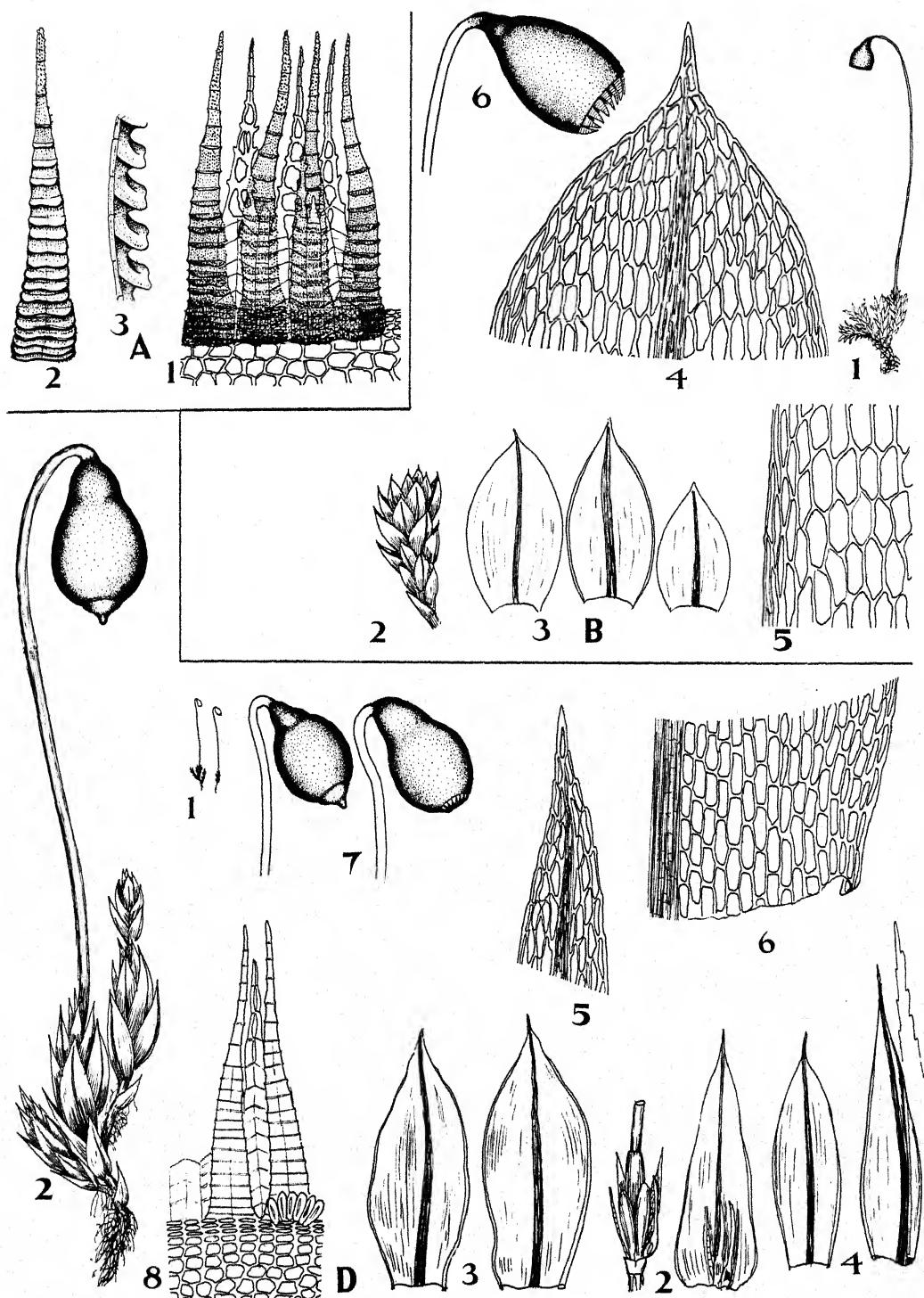
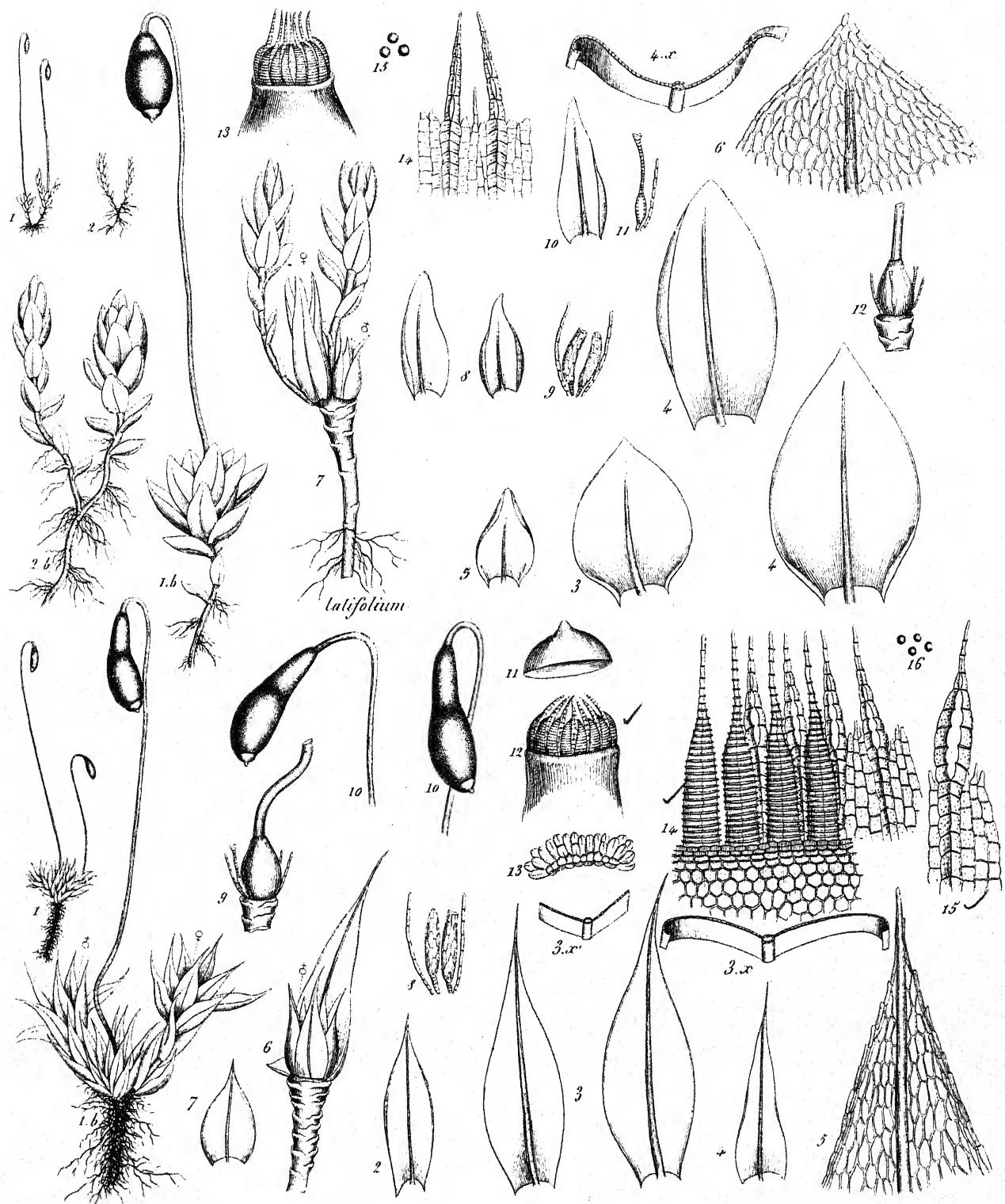


PLATE LXXXVI

PLATE 87. *Bryum calophyllum* (from Bry. Eur. *pl. 339*, as *B. latifolium*). 1, 2, plants  $\times 1$ ; 1b and 2b, the same enlarged; 3, 4, 5, leaves; 4x, cross section of leaf; 6, leaf apex showing cells; 7, portion of stem bearing archegonia and antheridia; 8, perigonial leaves; 9, antheridia; 10, perichaetial leaf; 11, archegonium and paraphysis; 12, vaginule; 13, mouth of capsule and peristome; 14, inner peristome; 15, spores.

*Bryum cernuum* (from Bry. Eur. *pl. 339*, as *B. uliginosum*). 1, plant  $\times 1$ ; 1b, the same enlarged; 2-4, leaves; 3x, 3x', median upper cross sections of leaf; 5, leaf apex showing cells; 6, antheridial bud; 7, perigonial leaf; 8, antheridia and paraphyses; 9, vaginule; 10, capsules; 11, operculum; 12, mouth of capsule and peristome; 13, annulus; 14, portion of peristome; 15, portion of inner peristome showing segment and rudimentary cilia; 16, spores.



*uliginosum*

PLATE LXXXVII

PLATE 88. A. *Bryum lacustre* (from Bry. Eur. *pl. 332*). 1b, plant enlarged; 3, 4, leaves; 4x, cross sections of leaf; 6, leaf apices showing cells; 7, antheridia and archegonia; 11, 12, capsules; 13, annulus; 14, mouth of capsule with peristome; 15, portion of peristome; 16, spores.

B. *Bryum turbinatum* (from Bry. Eur. *pl. 372*). 1, plants  $\times 1$ ; 1b, plant enlarged; 4, 5, 6, leaves; 7, leaf apex showing cells; 12, 13, perichaetial leaves; 5x, 5x', 5x'', cross sections of leaf; 15, mature operculate capsule; 16, dry and empty capsule; 17, mouth of capsule with peristome; 18, annulus; 19, appendiculate cilium; 20, spores.

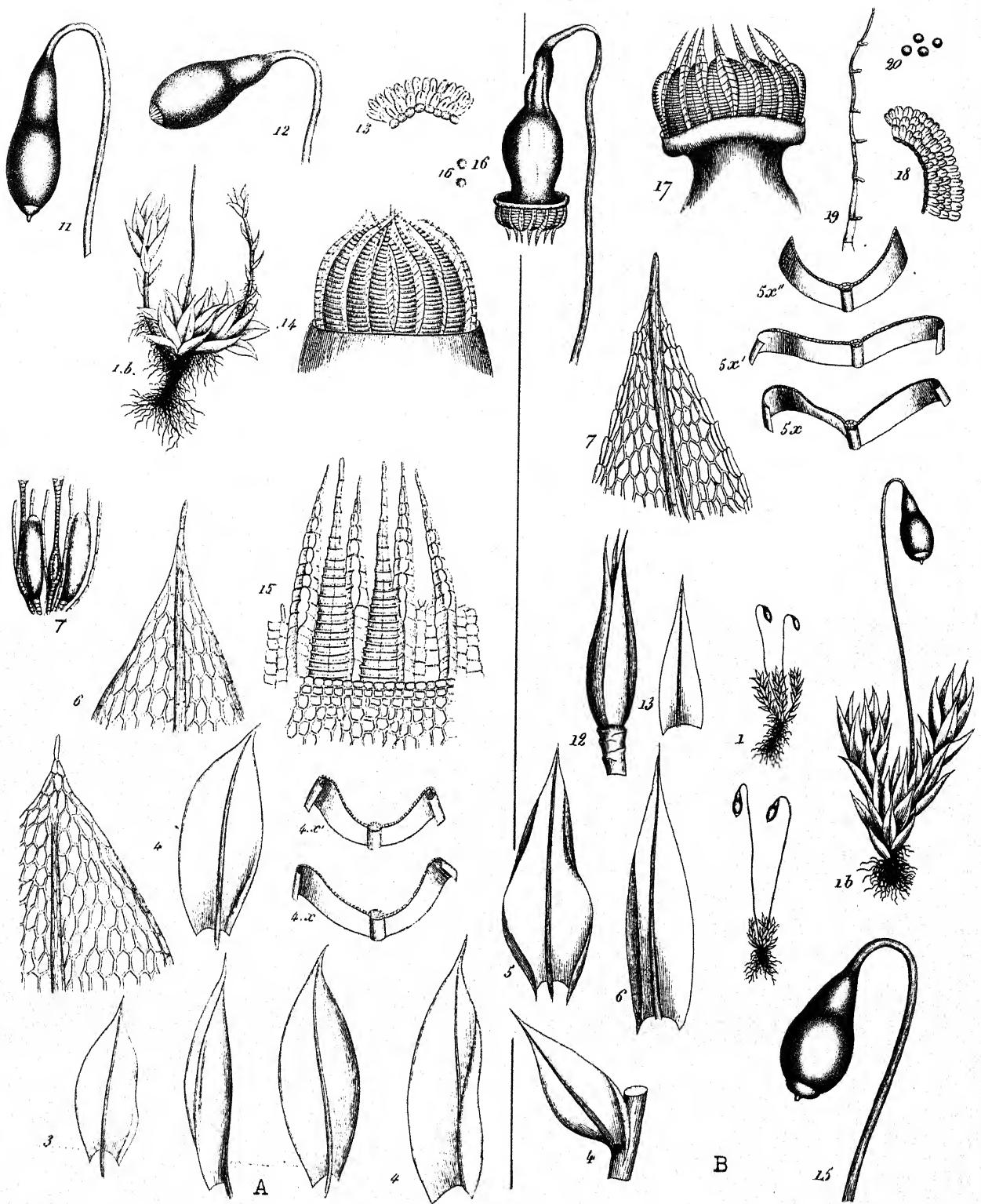


PLATE LXXXVIII

PLATE 89. *A. Bryum tortifolium* (from Bry. Eur. *pl. 370*, as *B. cyclophyllum*). 5, 6, leaves; 5x, 5x', cross sections of leaf; 7, cells of leaf apex; 13, 14, capsules; 15, annulus; 16, portion of peristome; 17, spores; 18, axillary filaments.

*B. Bryum Weigelii* (from Bry. Eur. *pl. 371* as *B. Duvalii*). 1, plant X 1; 3, 4, leaves; 4x, 4x', cross sections of leaf; 5, leaf apex showing cells; 12, 13, capsules.

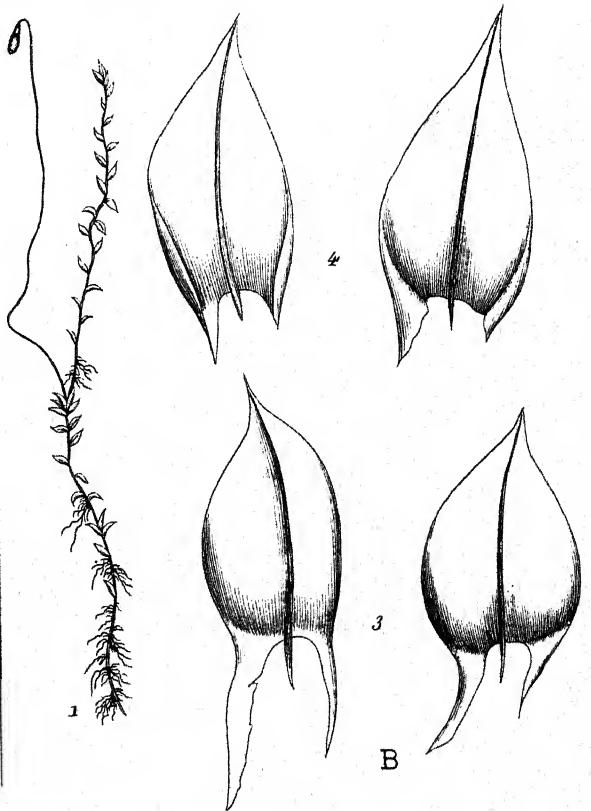
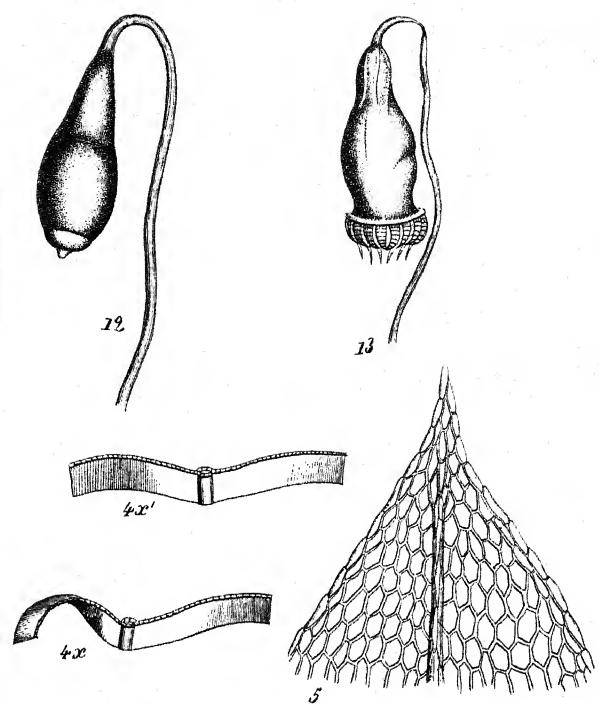
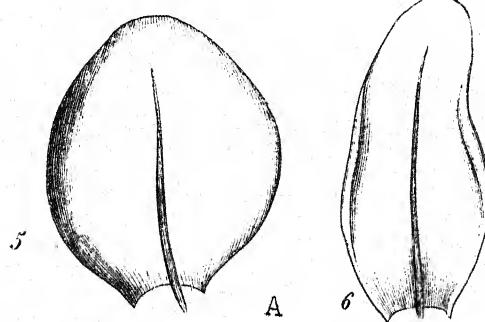
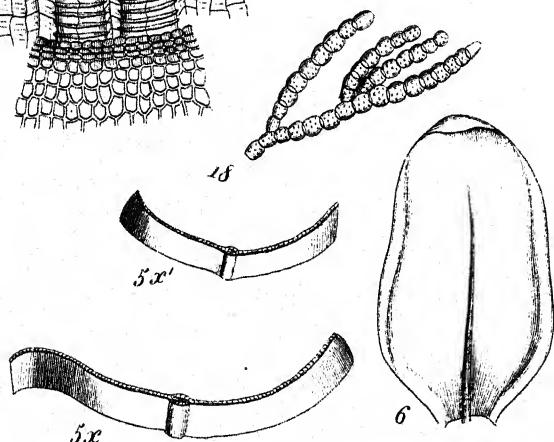
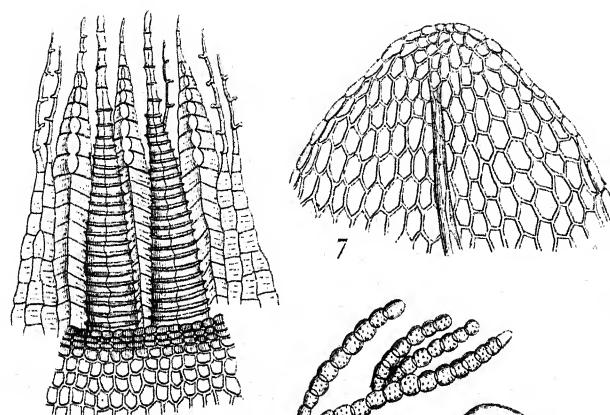
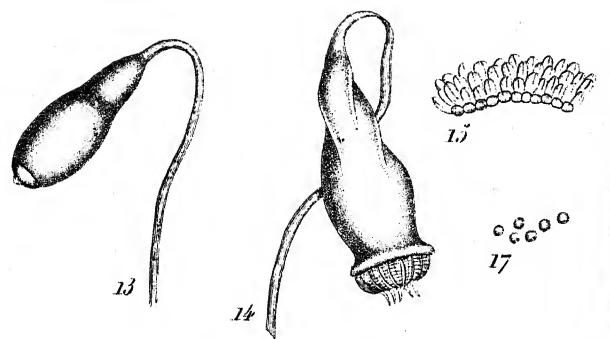


PLATE LXXXIX

PLATE 90. *A. Bryum alpinum* (from Bry. Eur. *pl. 380*). 1, plants  $\times 1$ ; 4, 5, leaves; 4x, 4x', cross sections of leaf; 6, leaf apex showing cells; 10, antheridium and paraphysis; 12, 13, capsules; 15, annulus; 16, portion of peristome; 17, spores.

*B. Bryum pallescens* (from Bry. Eur. *pl. 359*). 1, plants  $\times 1$ ; 4, 5, 6, leaves; 7, 8, leaf apices showing cells; 5x, 5x', cross sections of leaf; 16, 17, capsules; 18, mouth of capsule with peristome.

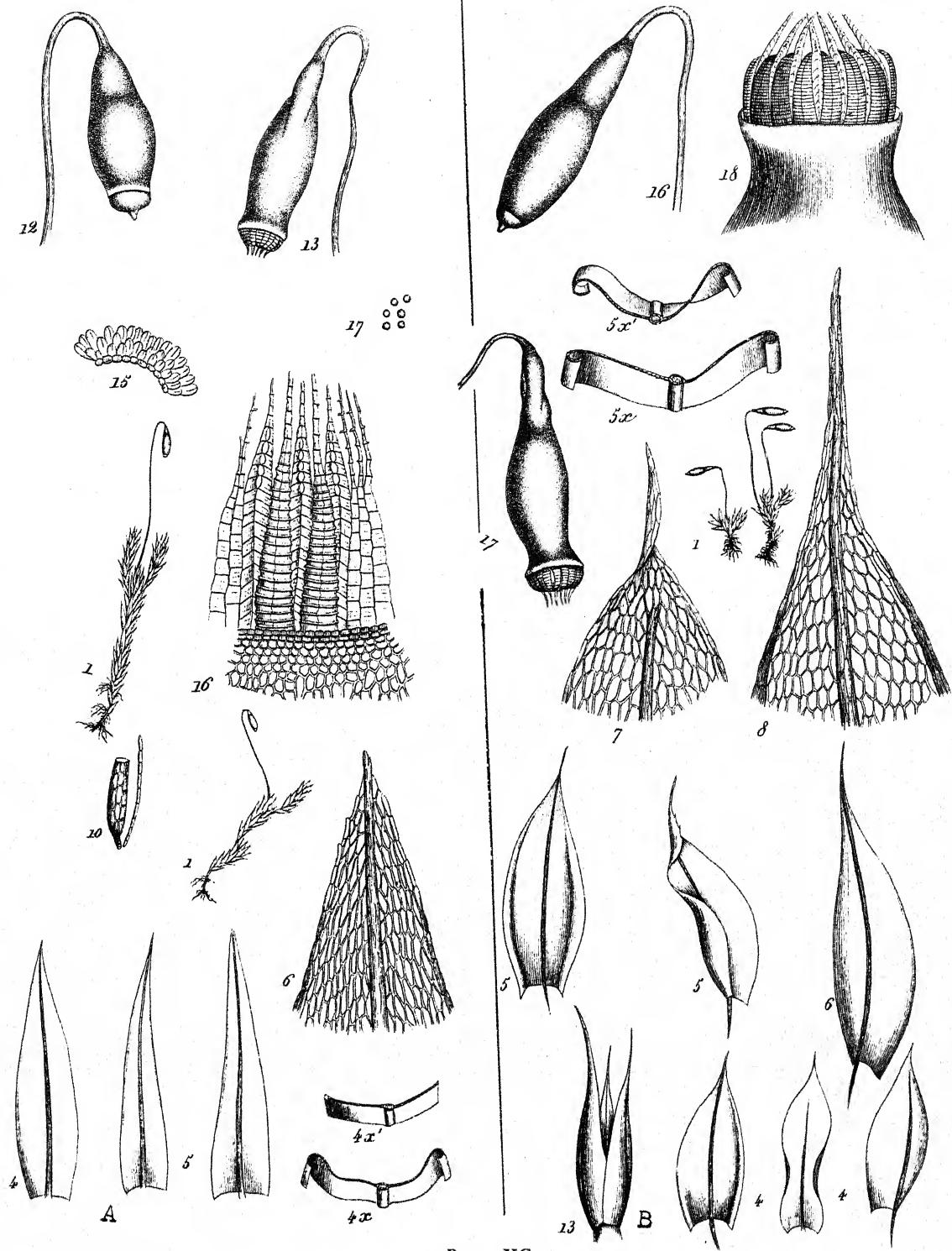


PLATE XC

PLATE 91. *A. Bryum truncorum*. 1, antheridial plant  $\times 3$ ; 2, fertile plant  $\times 3$ ; 3, comal leaf  $\times 20$ ; 4, upper leaf  $\times 20$ ; 4', lower leaves  $\times 20$ ; 5, median cells of flattened leaf margin; 6, median leaf cells  $\times 200$ ; 7, leaf apex  $\times 200$ ; 8, apex of upper leaf  $\times 200$ .

*B. Bryum miniatum*. 1, plant  $\times \frac{2}{3}$ ; 2, lower leaf  $\times 20$ ; 3, middle leaf  $\times 20$ ; 4, upper leaf  $\times 20$ ; 5, median leaf cells  $\times 200$ ; 6, marginal cells  $\times 200$ ; 7, leaf apex  $\times 200$ . (All by Seville Flowers.)

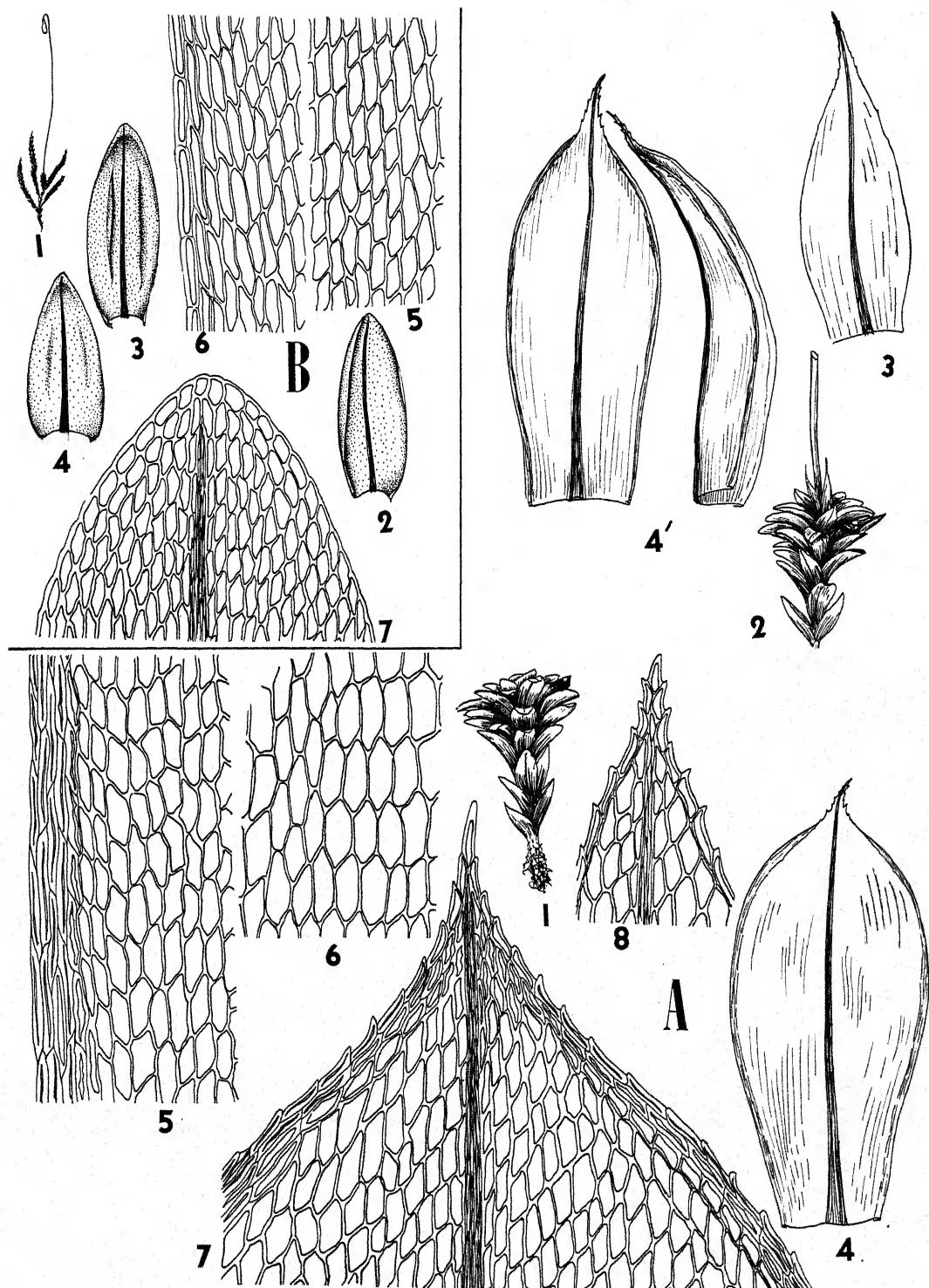


PLATE XCI

PLATE 92. *A. Bryum coronatum*. 1, plant  $\times 1$ ; 2, lower leaves from Sull. & Lesq. Musc. Bor. Am. no. 117  $\times 20$ ; 3, lower leaf from Grout's Manatee, Fla. specimen  $\times 20$ ; 4, upper leaves from the same  $\times 20$ ; 5, perichaetial leaves from Musc. Bor. Am. 117  $\times 20$ ; 6, basal marginal leaf cells  $\times 200$ ; 7, median marginal cells  $\times 200$ ; 8, leaf apex  $\times 200$ ; 9, moist and dry deoperculate capsules  $\times 13$ ; 10, operculate capsules  $\times 13$ .

*B. Bryum cuspidatum*. 1, lower leaves  $\times 20$ ; 2, upper leaves  $\times 20$ ; 3, synoicous inflorescence  $\times 33$ .

*C. Bryum longisetum*. 1, plants a little reduced in size; 2, plants  $\times 1.3$ ; 3, moist capsules  $\times 13$ ; 4, dry capsule  $\times 13$ . (All by Seville Flowers.)

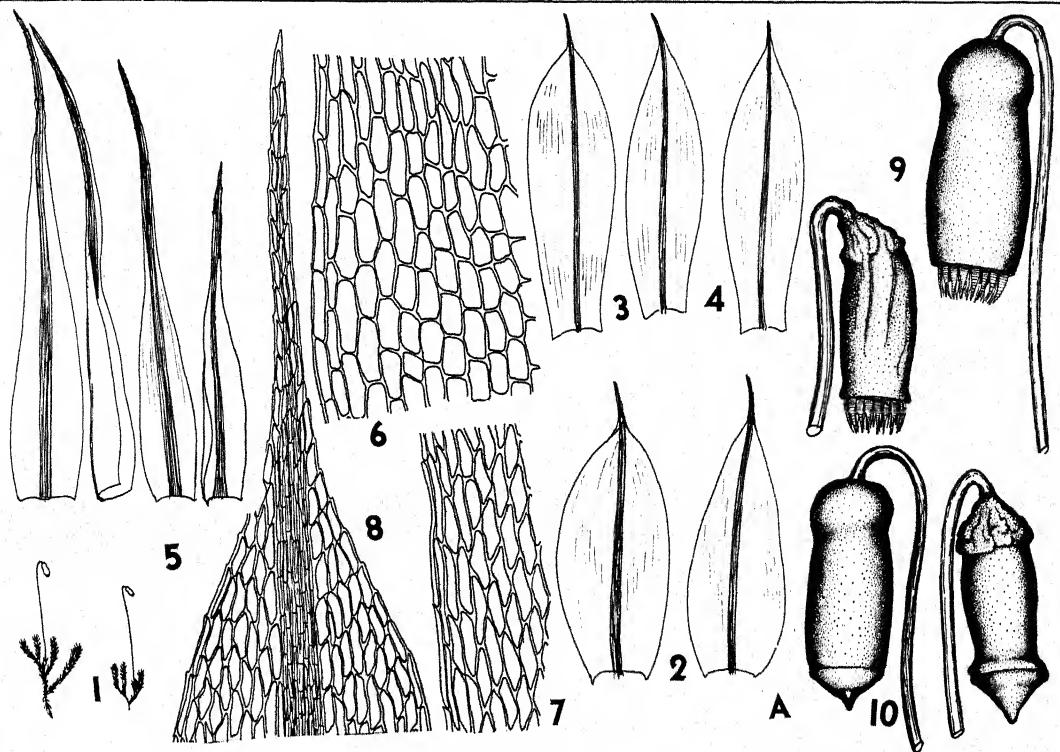
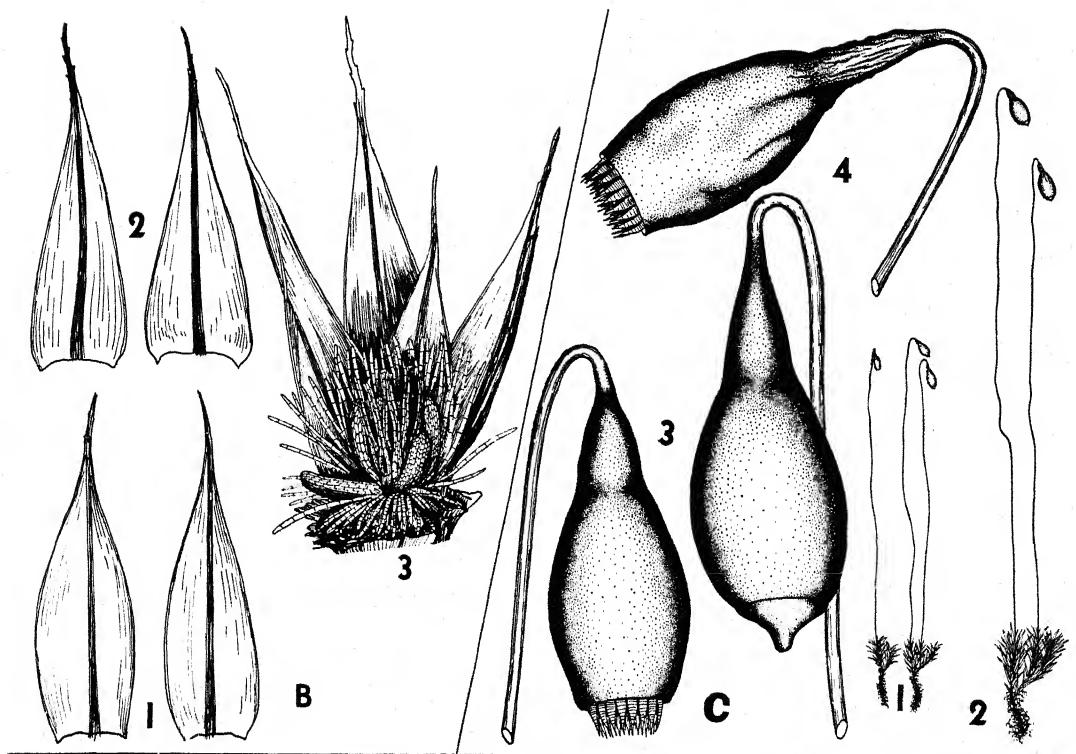


PLATE XCII

*Drymocarpus coronatus*

PLATE 93. A. *Bryum oeneum* (from Bry. Eur. *pl. 338*). 1, plants  $\times 1$ ; 3, portion of stem showing leaves and axillary filaments; 4, a single filament more enlarged; 5, 6, leaves; 6a, leaf apex showing costa and cells; 8, perichaetial leaf; 9, leaf; 11, moist ripe capsule; 13, the same dry; 14, portion of peristome; 15, a tooth and segment of the same more enlarged; 16, spore.

B. *Bryum archangelicum* (from Bry. Eur. *pl. 333*). 2, plant  $\times 1$ ; 4, 5, 6, leaves; 6a, leaf apices; 6ab, basal leaf cells; 9, 10, capsules; 11, annulus; 12, portion of peristome; 13, portion of endostome showing lack of cilia; 14, spores.

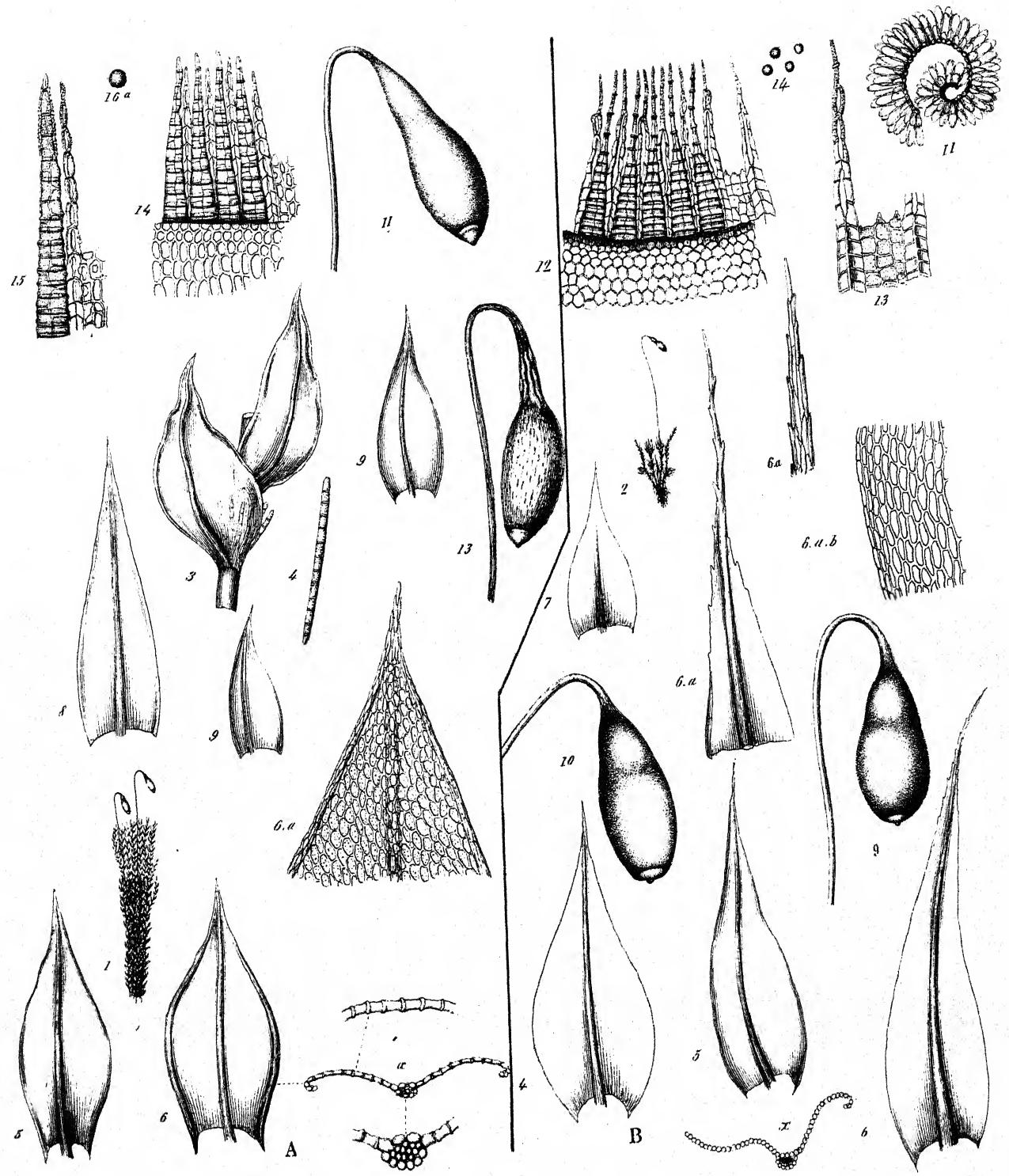


PLATE XCIID

PLATE 94. *A. Bryum gemmiparum* DeNot. (from Bull. N. Y. Bot. Gard. 2: *pl. 38* as *B. Williamsii* Philib.). 1, male and female plants  $\times 1$ ; 2, stem leaves  $\times 16$ ; 3, 4, inner and outer perichaetial leaves; 5, antheridium and two perigonal leaves; 6, apex of stem leaf  $\times 285$ ; 7, alar cells  $\times 285$ ; 8, marginal cells  $\frac{1}{2}$  down the leaf  $\times 285$ ; 9, part of peristome, annulus and exothecial cells  $\times 205$ ; 10, stoma  $\times 285$ ; 11, capsules  $\times 10$ .

*B. Bryum crassirameum* (from Bot. Gaz. 15: *pl. 8*). a, b, female and male plants  $\times 1$ ; c, leaves  $\times 17$ ; d, basal leaf cells  $\times 180$ ; e, median leaf cells  $\times 180$ ; f, leaf apex showing cells  $\times 180$ ; g, capsule  $\times 8$ ; h, portion of peristome  $\times 75$ .

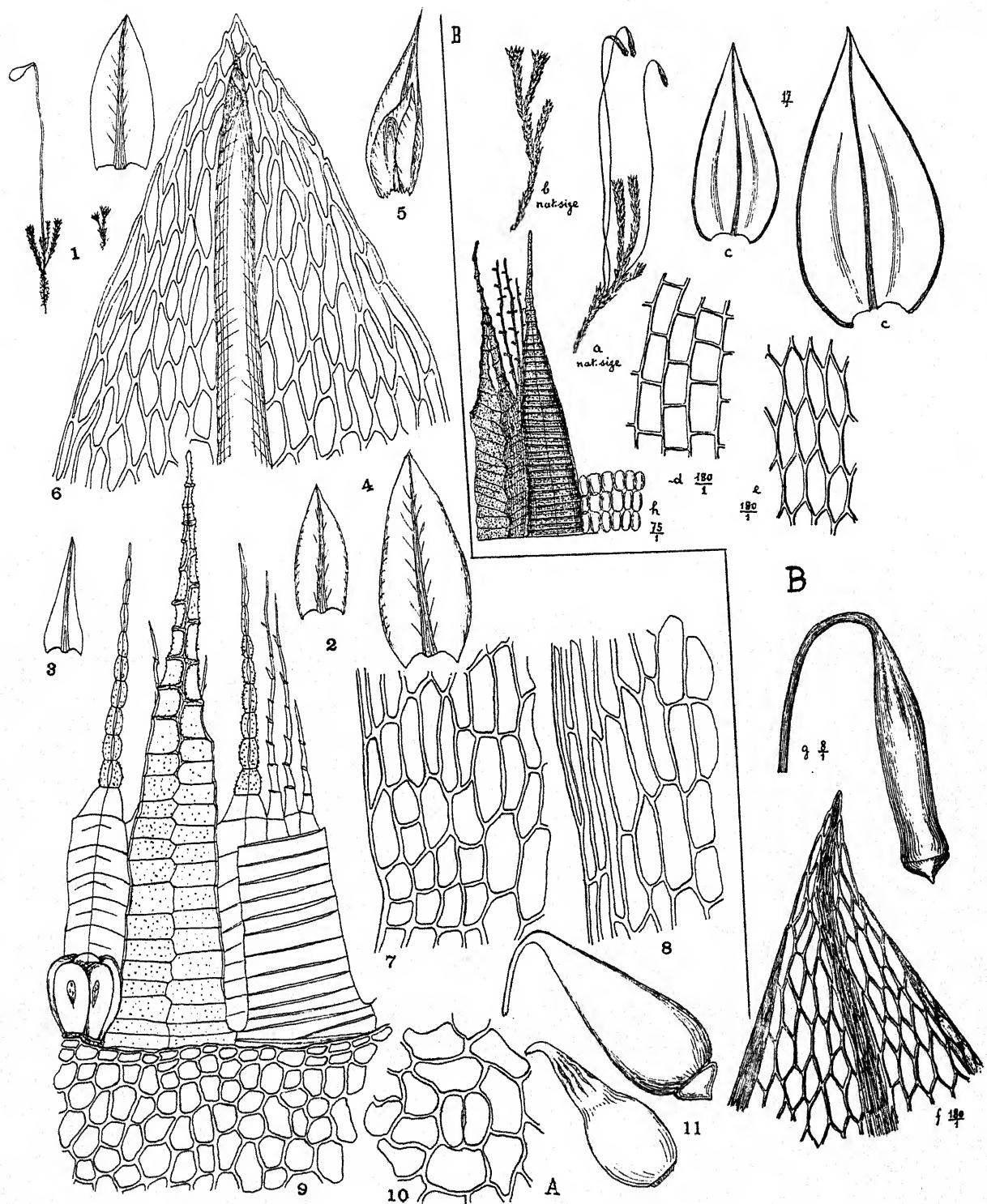


PLATE XCIV

PLATE 95. *A. Bryum cirratum* (from Bry. Eur. *pl. 357*). 1, 3, plants  $\times 1$ ; 10, leaf; 10x, portion of cross section of 10; 11, dry capsule; 15, moist capsule; 16, portion of peristome.

*C. Bryum canariense* (from Bry. Eur. *pl. 366*, as *B. Billarderi*). 1, plant  $\times 1$ ; 2, leaf; 2x, cross section of leaf near base; 3, cell structure of leaf apex; 4, moist capsule; 5, dry capsule.

*Bryum bicolor* (from Bry. Eur. *pl. 379* as *B. versicolor*). 1b, plants enlarged; 1, plants  $\times 1$ ; 2, 3, 4, leaves; 3x, 3x', cross sections of leaf; 5, leaf apex showing cells; 6, sterile plant  $\times 1$ ; 7, 8, perichaetium and leaves; 9, antheridia and paraphyses; 10, operculate capsules; 11, dry and empty capsule; 12, annulus.

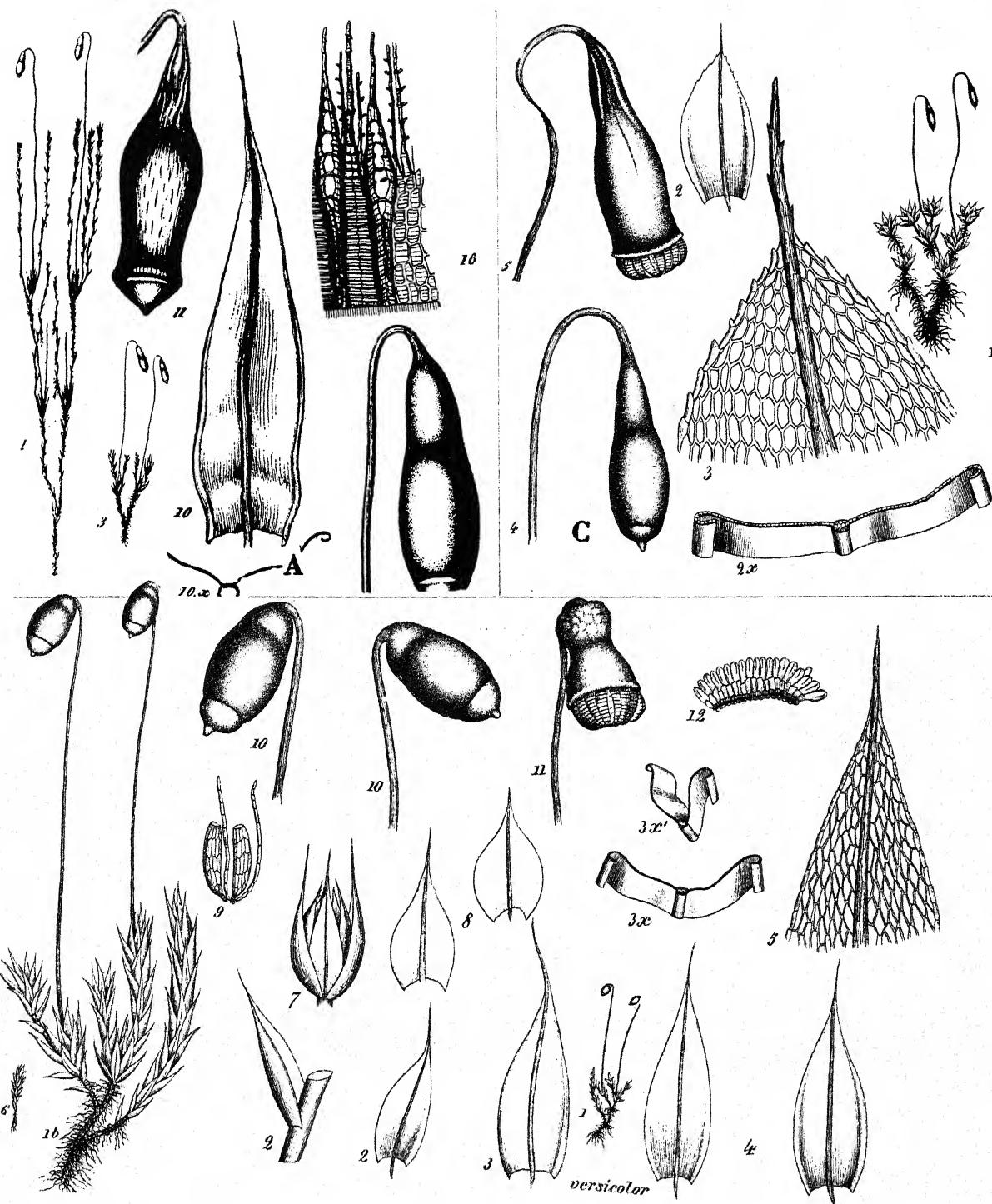
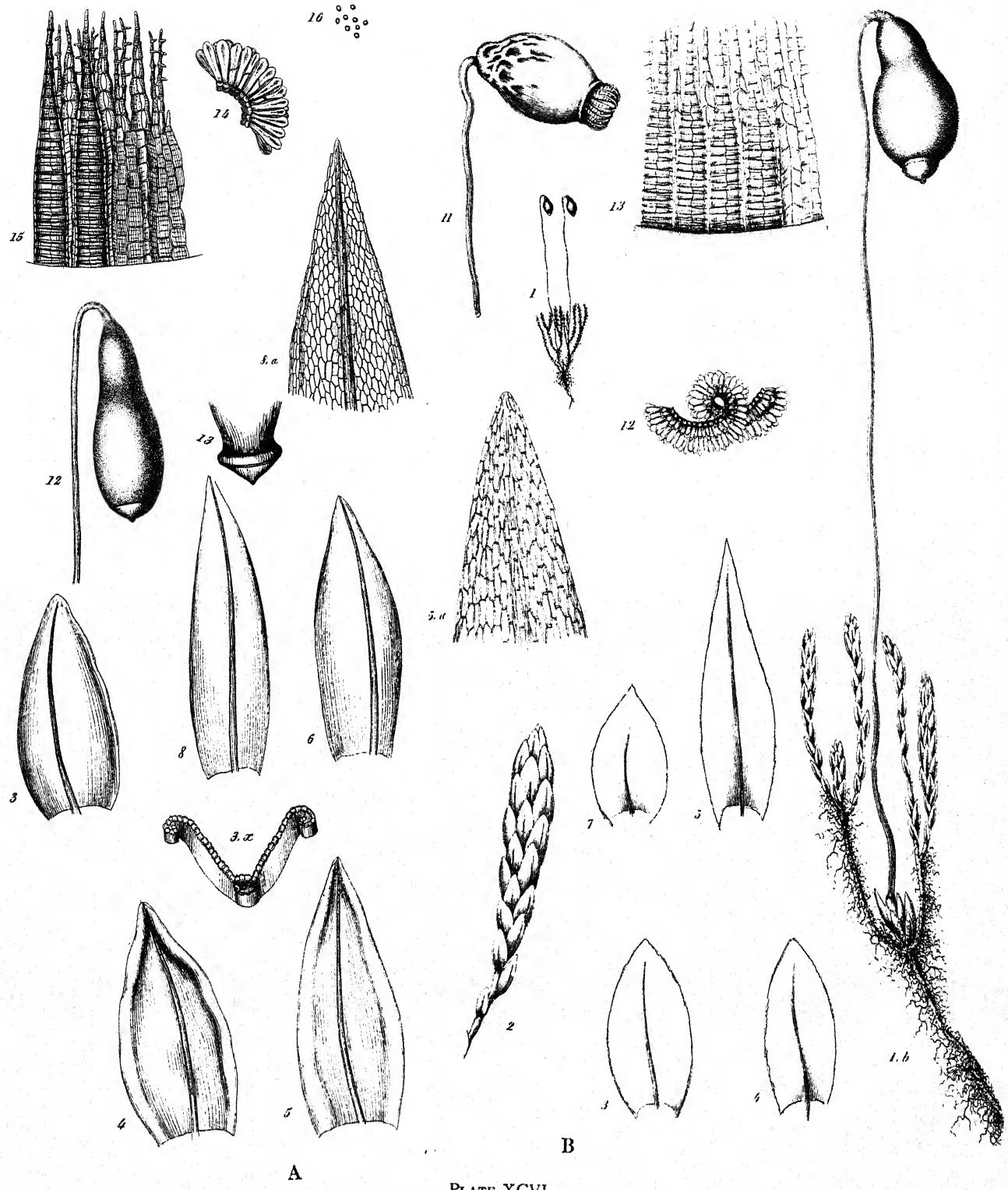


PLATE XCV

PLATE 96. *A. Bryum Mühlenbeckii* (from Bry. Eur. *pl. 381*). 3, 4, 5, 6, 8, leaves; 8a, leaf apex showing cells; 3x, cross section of leaf; 12, capsule; 13, mouth of dry capsule; 14, annulus; 15, portion of peristome; 16, spores.

*B. Bryum Blindii* (from Bry. Eur. *pl. 383*). 1, plants  $\times 1$ ; 1b, portion of same enlarged; 2, branch more enlarged; 3, 4, 5, 7, leaves; 5a, leaf apex showing cells; 11, dry and empty capsule; 12, annulus; 13, portion of peristome.



A

B

PLATE XCVI

PLATE 97. *A. Bryum Sandbergii.* 1, plants  $\times \frac{1}{2}$ ; 2, leaf  $\times 13$ ; 3, upper leaf  $\times 13$ ; 4, perichaetial leaves  $\times 13$ ; 5, median marginal cells  $\times 200$ ; 6, leaf apex  $\times 200$ ; 7, capsules  $\times 7$ .  
*B. Peristome teeth of Bryum pendulum* ventral side  $\times 167$ . (All by Seville Flowers.)

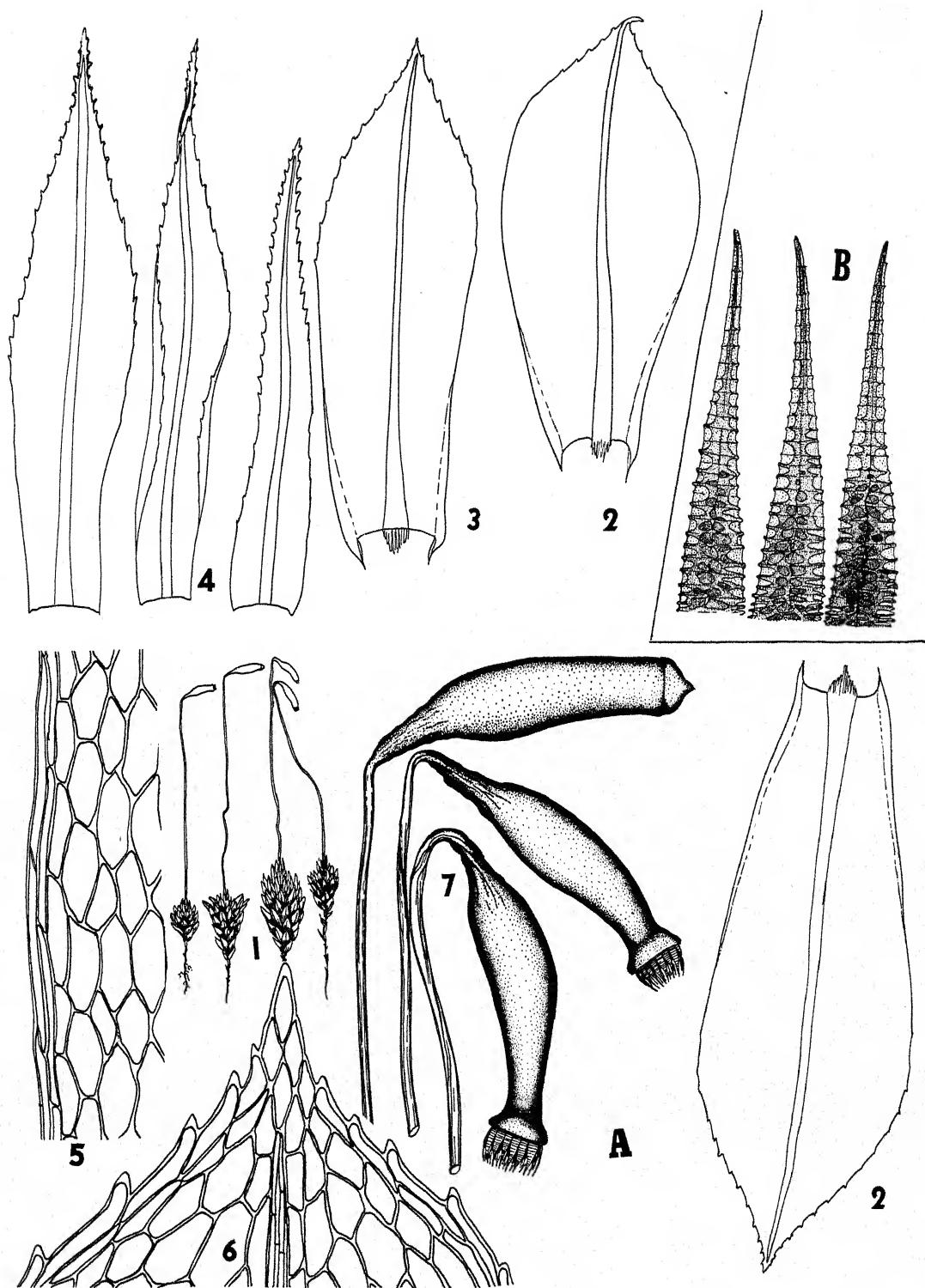


PLATE XCVII

PLATE 98. *A. Brachymenium macrocarpum*. 1, plants dry and moist  $\times 3$ ; 2, leaves  $\times 20$ ; 3, dorsal view of leaf apex  $\times 40$ ; 4, basal leaf cells  $\times 200$ ; 5, lower median leaf cells  $\times 200$ ; 7, leaf apex  $\times 200$ ; 8, capsule  $\times 13$ ; 9, portion of peristome viewed from the inner side  $\times 200$ ; 10, detail of peristome tooth  $\times 400$ .

*B. Bryum teres*. 1, plant  $\times 3$ ; 2, branch  $\times 7$ ; 3, leaves  $\times 20$ ; 4, leaf apex  $\times 200$ ; 5, median marginal leaf cells  $\times 200$ ; 6, capsule  $\times 13$ ; 7, basal marginal leaf cells  $\times 200$ . (A and B by Seville Flowers.)

*C. Bryum acutum* (as *B. Treleasei*) (from Proc. Wash. Acad. Sci. 4: pl. 20). 1a, plant  $\times 1$ ; 1b, leaves  $\times 10$ ; 1c, cross sections of leaf  $\times 105$ ; 1d, basal leaf cells of the same  $\times 105$ ; 1e, marginal leaf cells  $\times 105$ ; 1f, apical leaf cells  $\times 105$ ; 1g, moist young capsules  $\times 10$ .

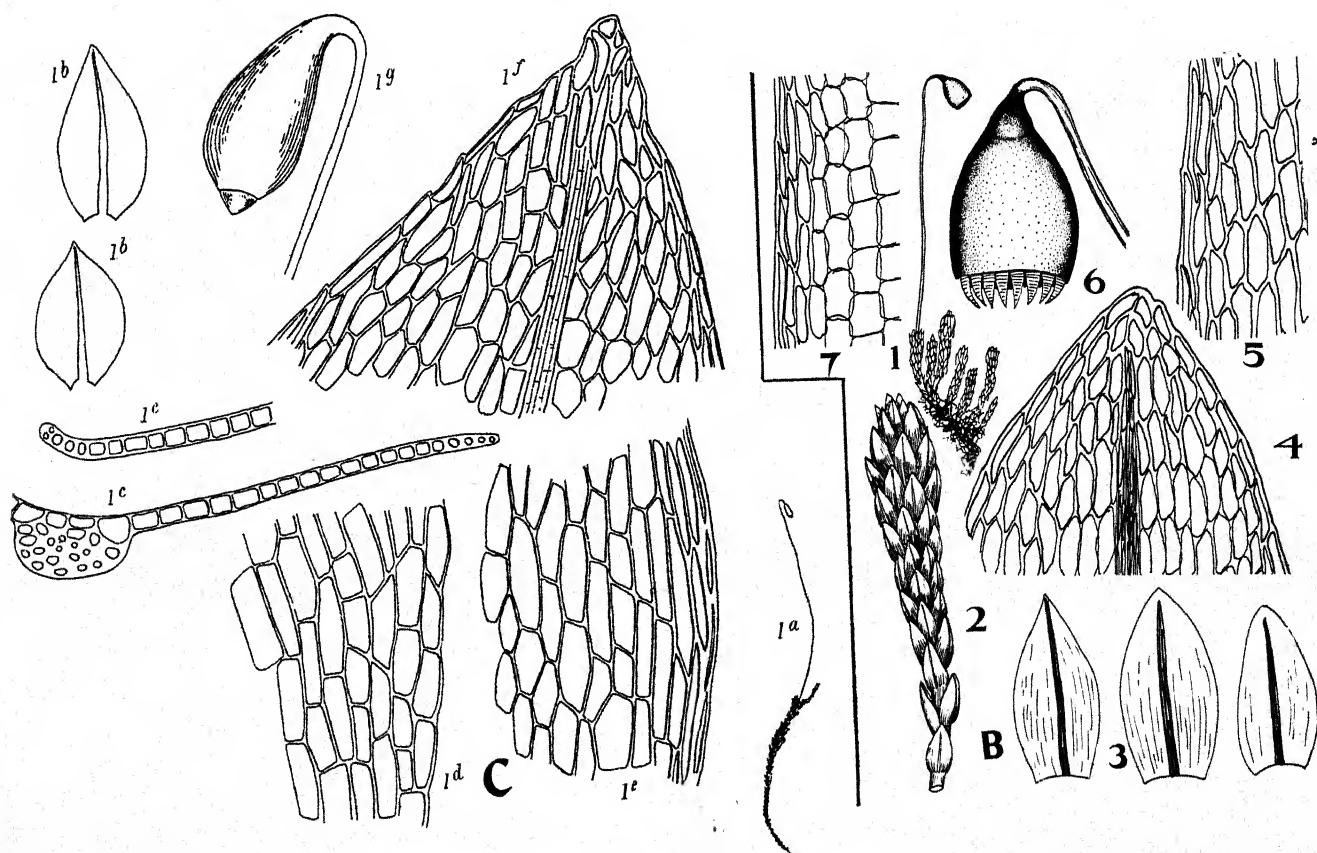
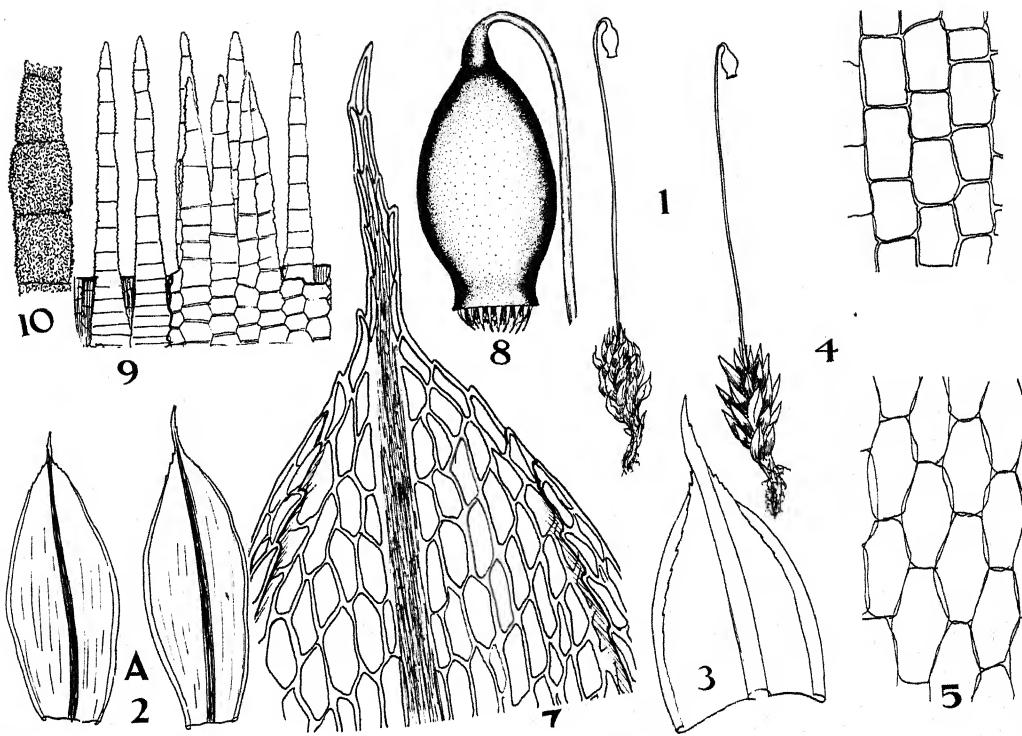


PLATE XCVIII

PLATE 99. *Mnium arizonicum*. 1, fruiting plants  $\times \frac{2}{3}$ ; 2, male plants  $\times \frac{2}{3}$ ; 3, lower leaf of fruiting plant  $\times 20$ ; 4, upper leaf of the same  $\times 20$ ; 5, 6, 7, lower median and upper leaves respectively of male plant  $\times 20$ ; 8, apex of leaf of female plant  $\times 200$ ; 9, basal marginal cells of the same  $\times 200$ ; 10, apex of 7  $\times 200$ ; 11, capsules  $\times 13$ ; 12, apex of leaf of *M. spinosum*  $\times 100$ , from Möller, Ark. för Bot. 21A, no. 1: f. 12. (Other drawings by Seville Flowers.)

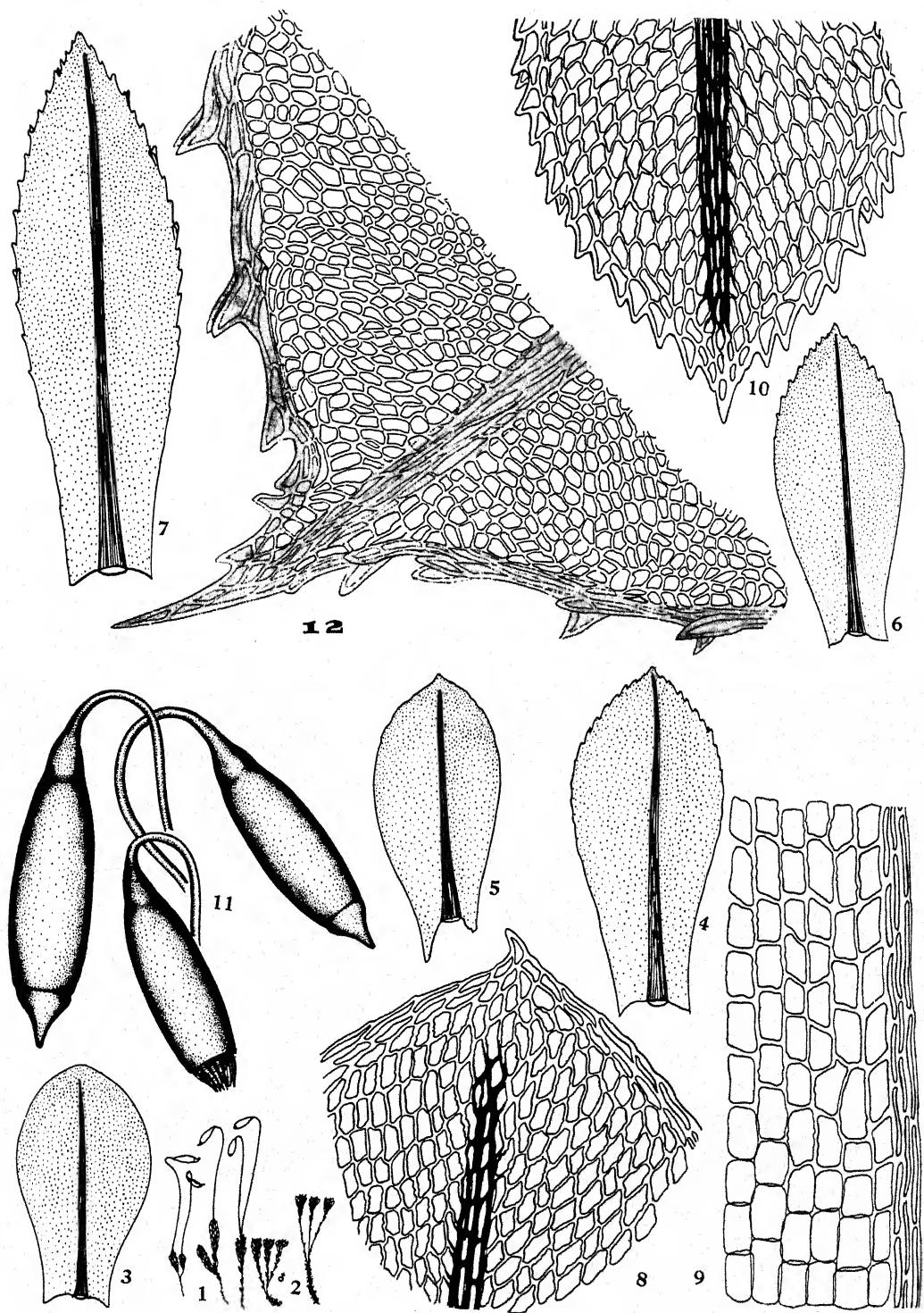


PLATE XCIX

PLATE 100. Left. *Mnium venustum* (from Sull. Icones Suppl. *pl. 36*). 1, plant  $\times 1$ ; 2, plant enlarged; 3, 4, leaves; 5, leaf cells; 6, capsules; 7, part of peristome; 8, antheridium, archegonium and paraphysis; 9, operculum.

Right. *Mnium Drummondii* (from Sull. Icones *pl. 51*). 1, plants  $\times 1$ ; 2, fruiting plant enlarged; 3, outer perichaetal leaves; 4, stem leaves; 5, apical leaf cells; 6, same in detail; 7, 8, capsules; 9, part of peristome; 10, operculum with apex of columella adhering; 11, operculum; 12, apex of stem showing antheridia, archegonia, paraphyses and a young sporophyte with calyptra; 13, archegonium, antheridium and paraphysis.

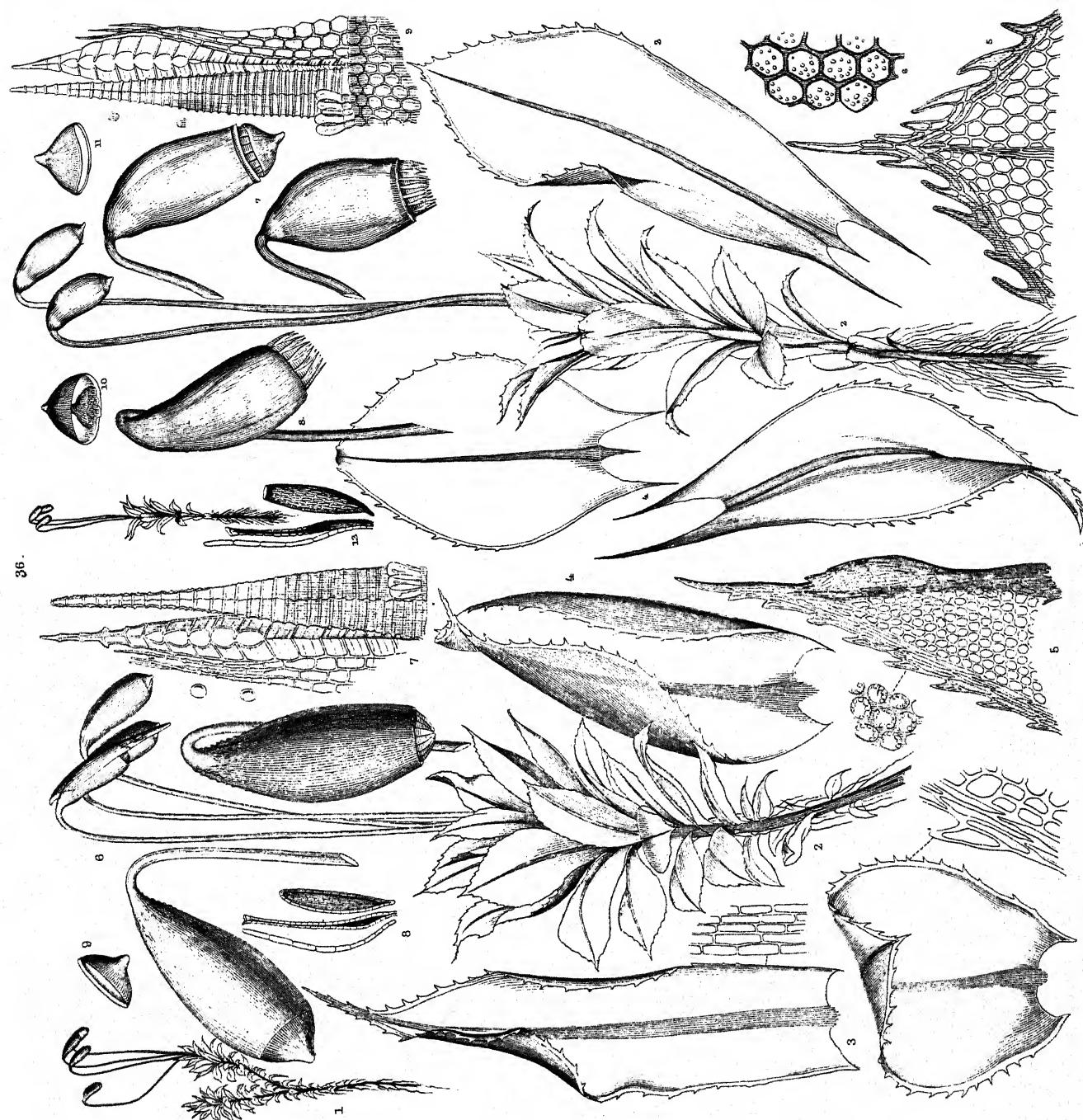
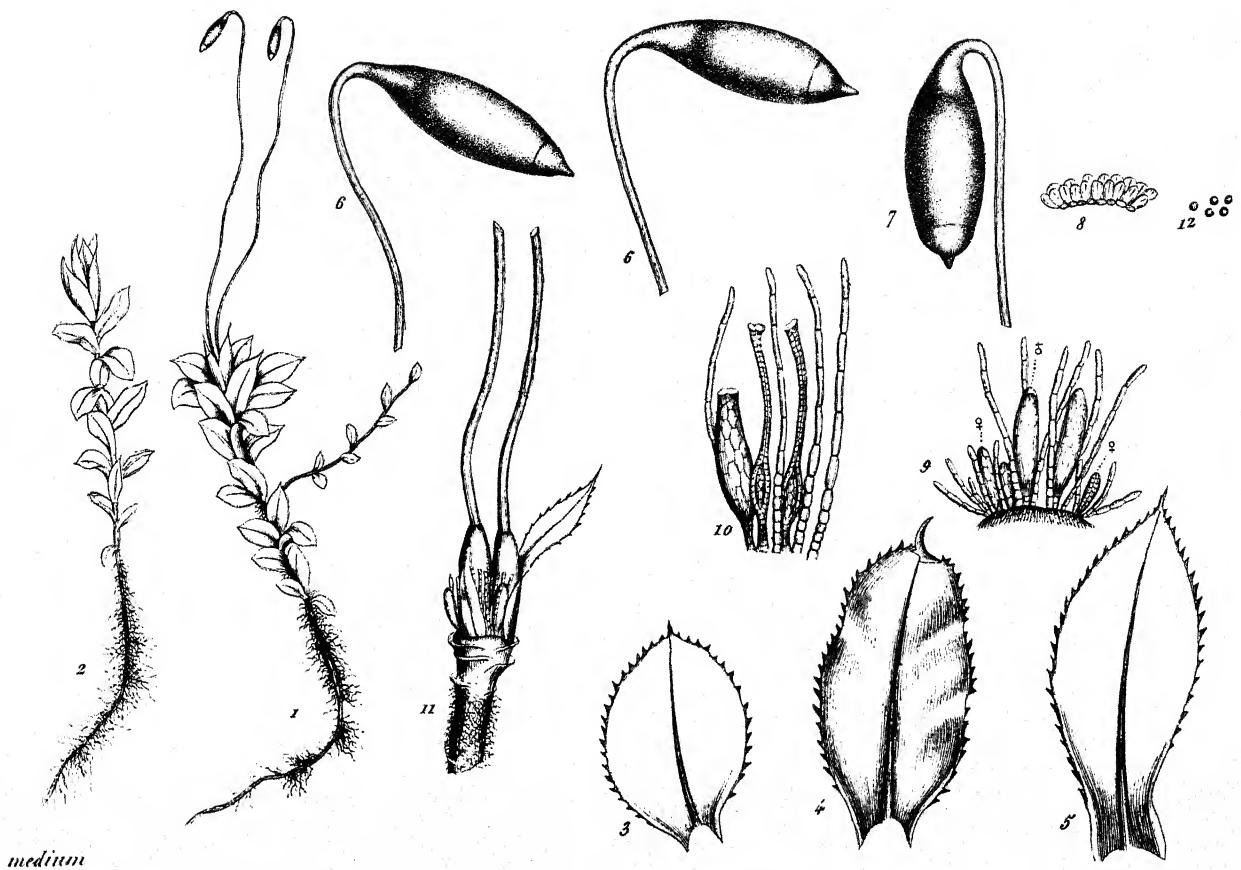


PLATE 101 (upper part). *Mnium medium* (from Bry. Eur. pl. 398). 1, 2, plants enlarged; 3, 4, 5, leaves from below upwards; 6, 7, capsules; 8, portion of annulus; 9, flowering head with antheridia only; 10, antheridium, archegonia and paraphyses; 11, end of stem bearing the same and 2 setae.

PLATE 101 (lower portion). A. Leaf cells of *Mnium affine*  $\times 150$  (from Möller, Arkiv för Botanik 21A: f. 27).

- B. Leaf cells of *Mnium medium*  $\times 150$  (l. c. f. 21).
- C. Leaf cells of *Mnium Drummondii*  $\times 150$  (l. c. f. 25).
- D. Leaf cells of *Mnium cuspidatum*  $\times 150$  (l. c. f. 19).



medium

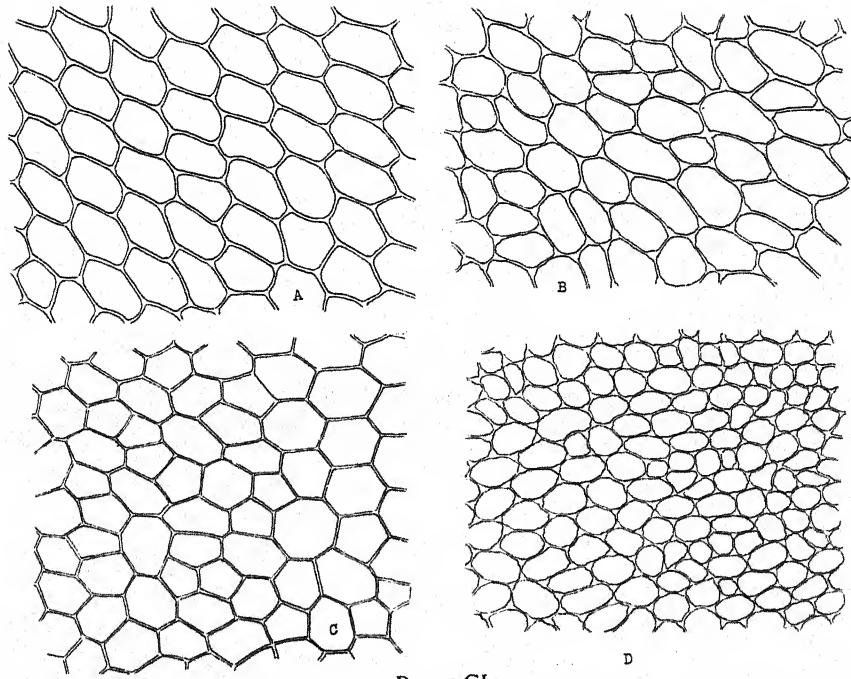


PLATE CI

PLATE 102. *Mnium Menziesii*. A, plants  $\times 2$  (photo by Beals); C, stem leaf  $\times 15$ ; D, branch leaf  $\times 20$ ; E, leaf apex  $\times 175$ ; F, portion of peristome  $\times 75$ ; G, dorsal plates of peristome tooth  $\times 300$ ; H, operculum  $\times 13$  (C-H, from Engler & Prantl, *Naturl. Pflanzenf.* (Ed. 2) 10: 410, f. 360, by permission).

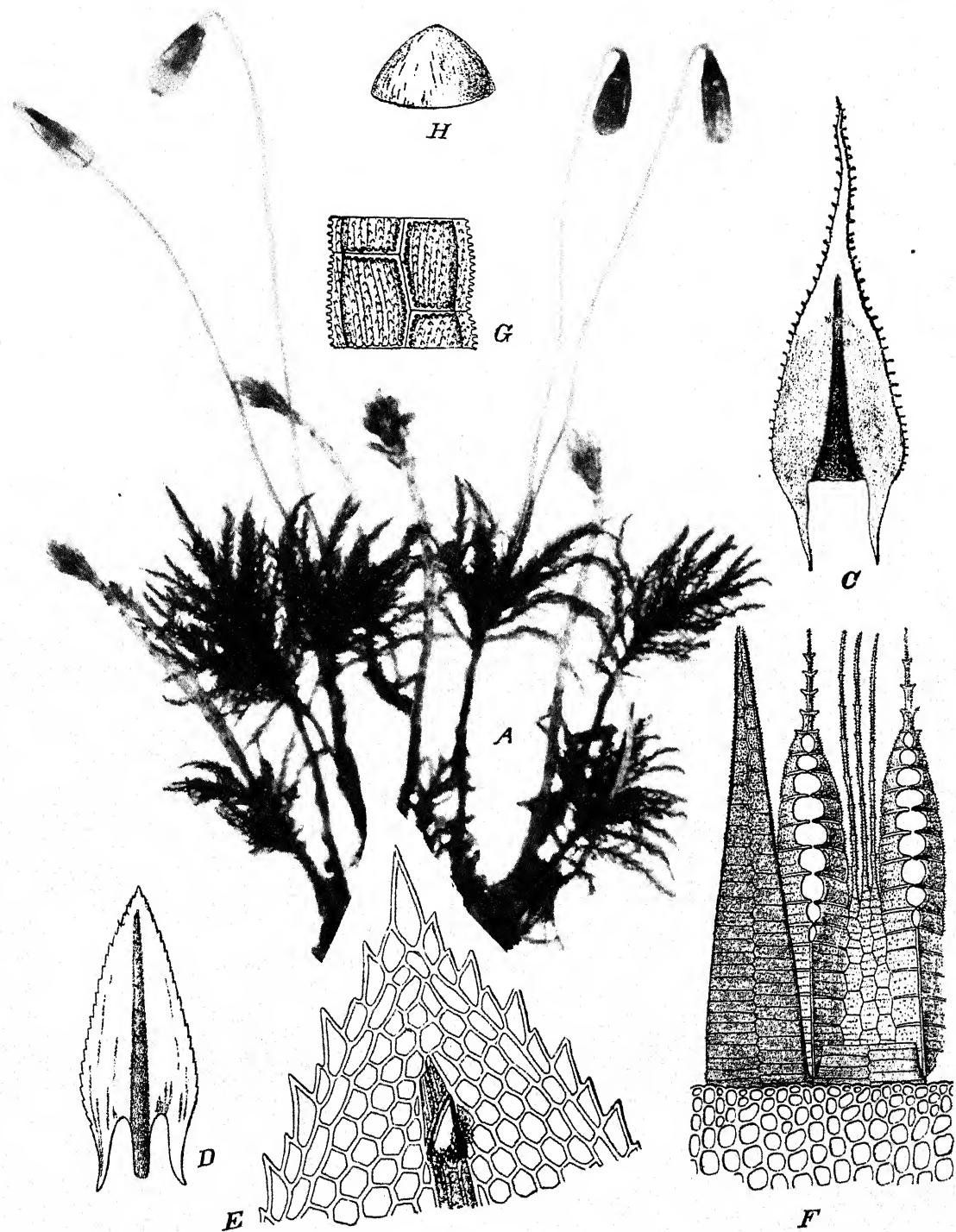
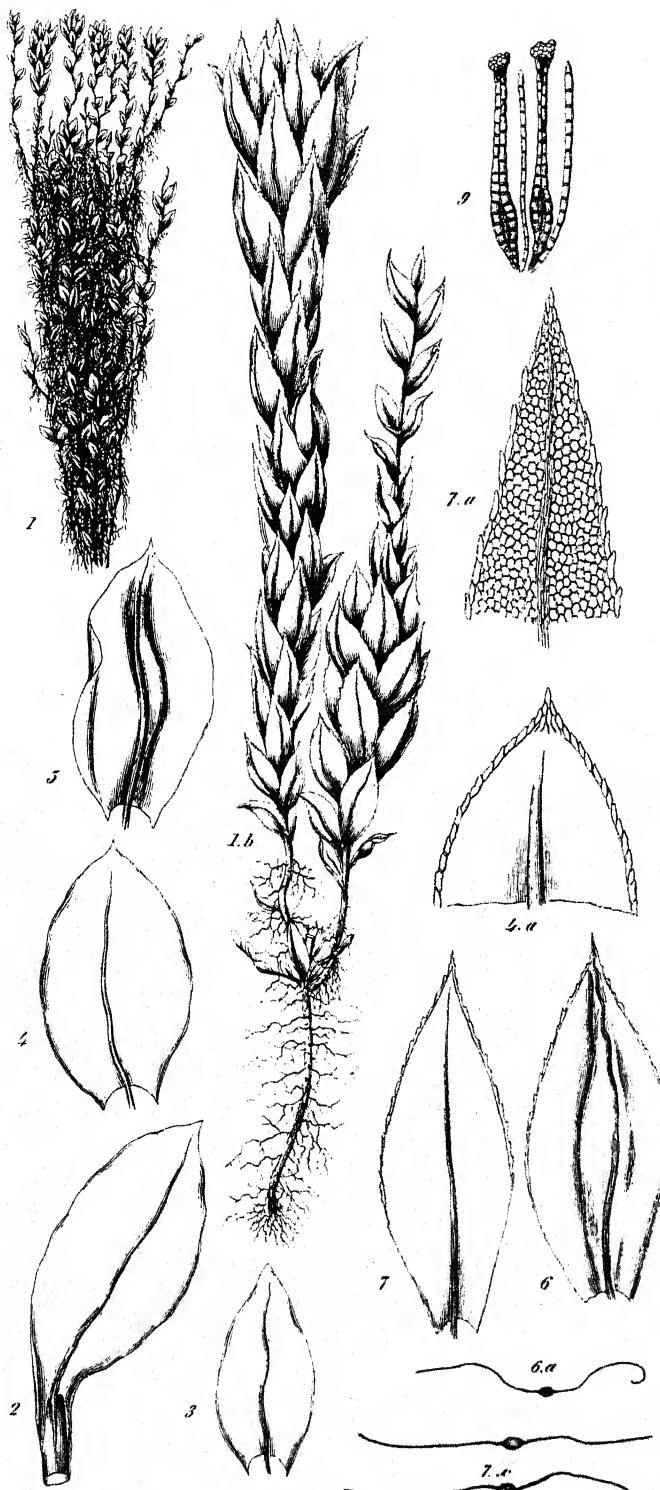


PLATE CII

PLATE 103. A. *Mnium Blyttii* (from Bry. Eur. *pl. 400*). 1, plants  $\times 1$ ; 1b, plant enlarged; 2-6, leaves; 6a, cross section of 6; 7, perichaetal leaf; 7x, cross sections of 7; 4a, apex of 4 showing slight border; 7a, apex of 7 showing cells; 9, archegonia.

B. *Mnium flagellare* (from Pub. Puget Sd. Biol. Sta. 3: *pl. 8*). 28, leaf from upper part of old stem just below the comal head  $\times 25$ ; 29, leaf from median portion of sterile stem  $\times 25$ ; 30, margin of 29 from the upper  $\frac{3}{4} \times 250$ ; 31, margin of 28 from the upper  $\frac{3}{4} \times 250$ ; 32, cells of 28 at lower median insertion  $\times 250$ ; 33, cross section of margin of mature leaf from stem bearing flagella  $\times 250$ ; 34, cross section through middle of leaf from young sterile stem  $\times 250$ ; 35, section of costa about middle of mature flagella-bearing leaf  $\times 250$ .



*Blyttii*

PLATE CIII

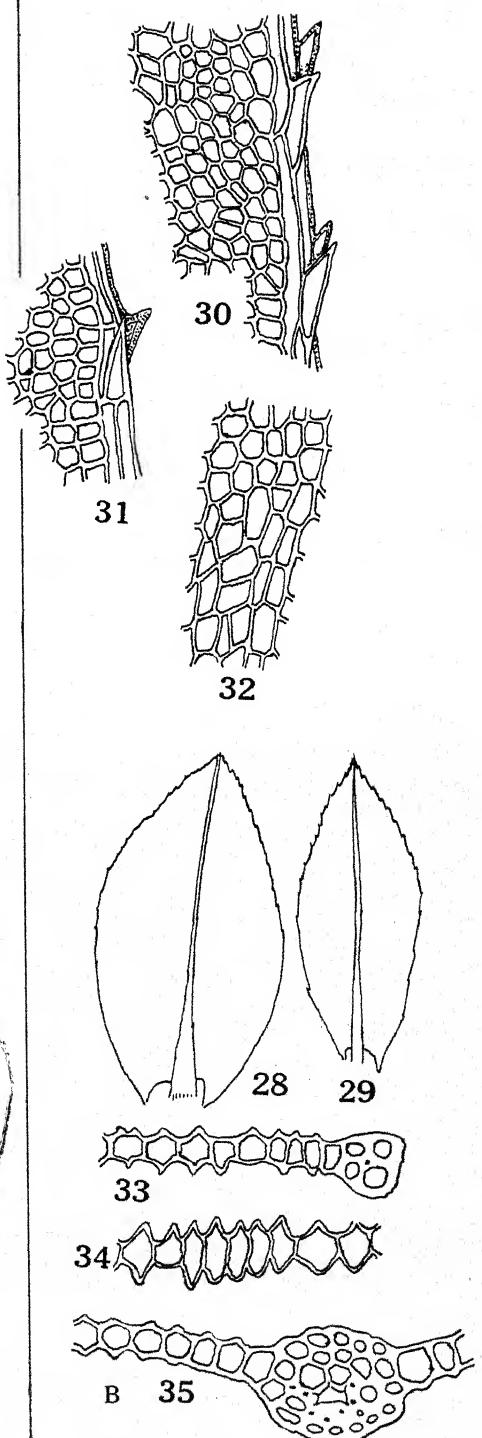


PLATE 104. A (left). *Mnium lycopodioides* (from Sull. Icones Suppl. *pl. 35*, as *M. umbratile* Mitt.). 1, plants  $\times 1$ ; 2, plant enlarged; 3, portion of stem showing decurrent leaves; 4, comal stem leaf; 5, outer perichaetial leaves; 6, inner perichaetial leaf; 7, cross section of leaf; 8, upper portion of leaf showing cells; 9, capsules; 10, part of peristome.

B (right). *Mnium insigne* (from Sull. *I. c. pl. 37*). 1, fertile plant  $\times 1$ ; 2, fertile plant enlarged; 3, stem leaves; 4, inner perichaetial leaf; 5, apex of leaf showing cells; 6, capsules; 7, part of peristome and annulus; 8, operculum; 9, antheridial head and antheridia.

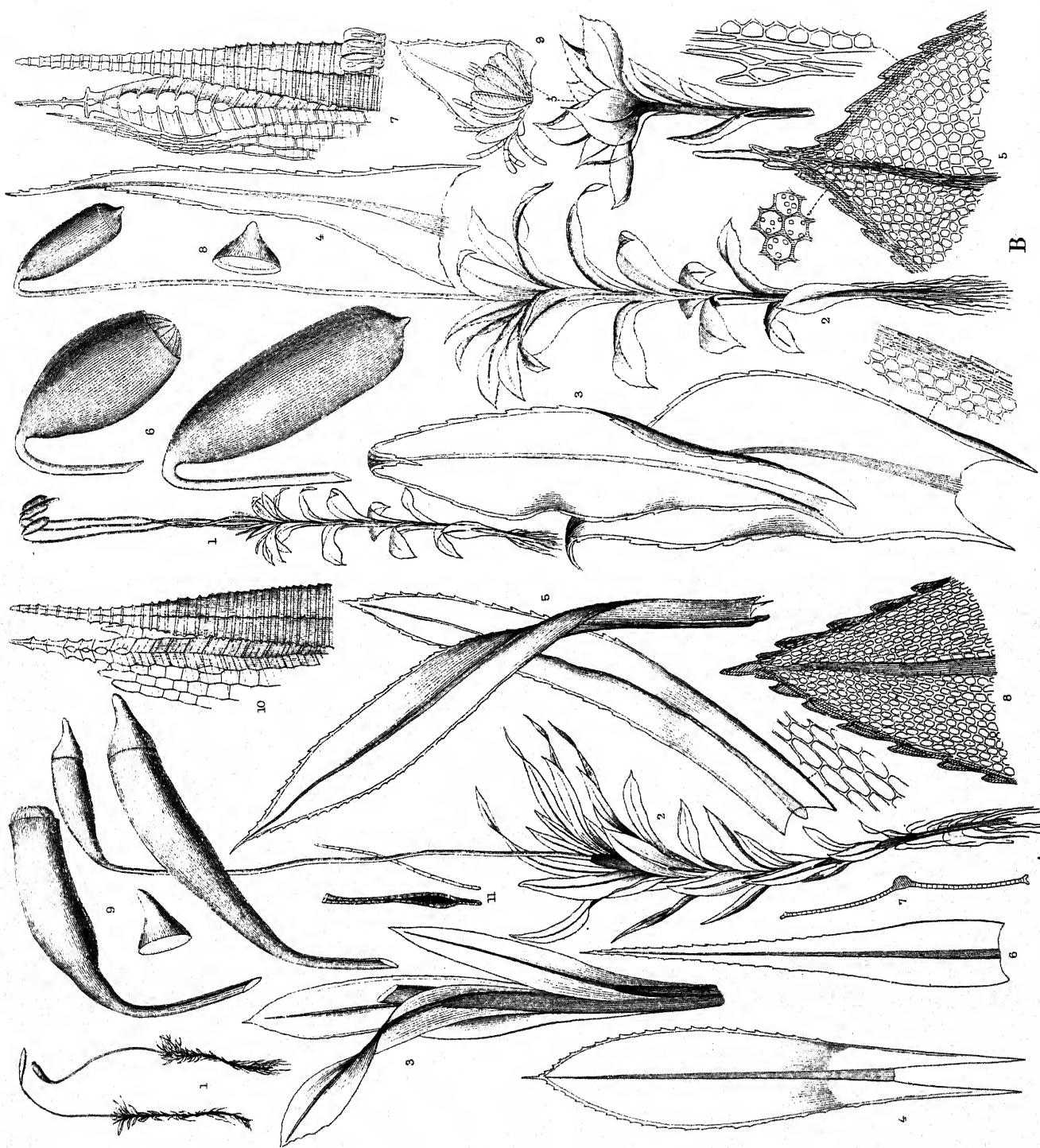


PLATE 105 (from Möller, Arkiv f. Botanik 21A, no. 1). 1, leaf cells of *Mnium marginatum*  $\times 300$  (f. 11); 2, of *M. orthorhynchum*  $\times 300$  (f. 2); 3, of *M. lycopodioides*  $\times 300$  (f. 6); 4, of *M. hornum*  $\times 300$  (f. 1).

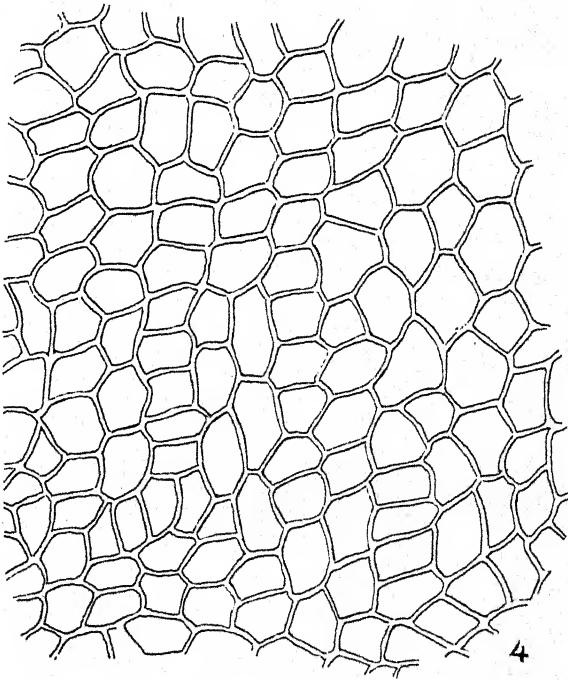
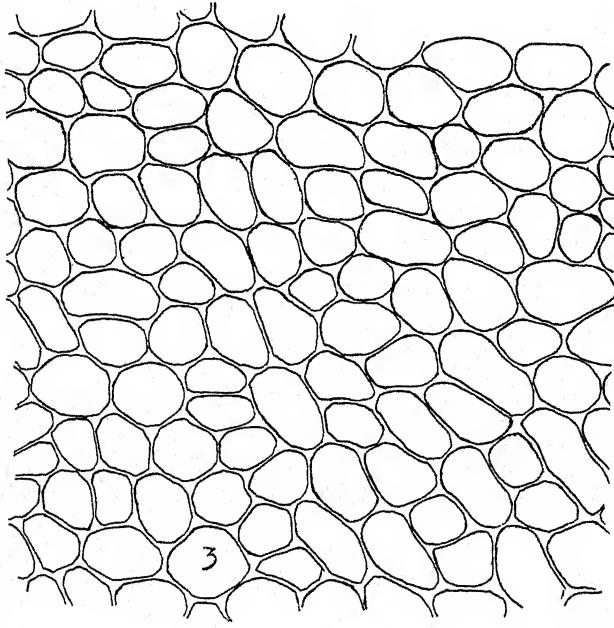
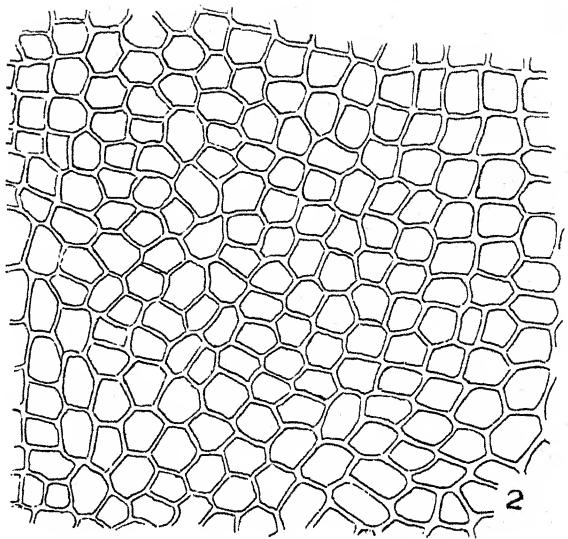
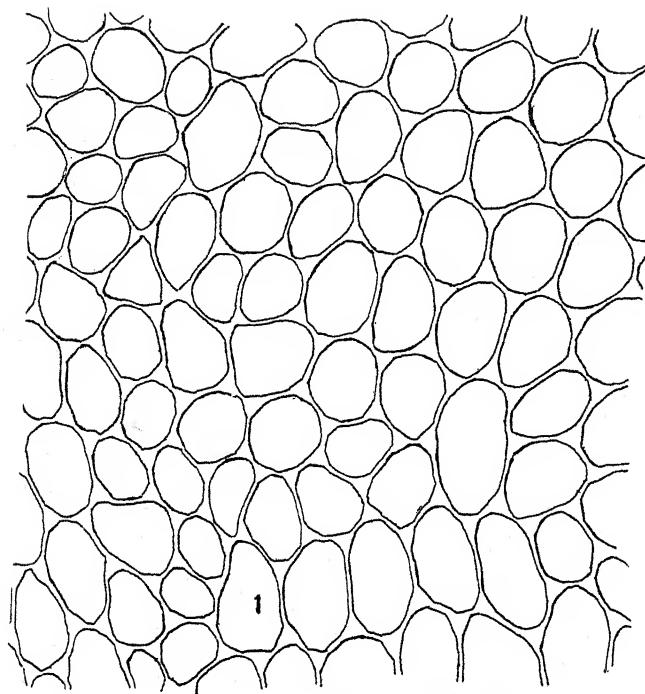


PLATE CV

PLATE 106. *Cinclidium stygium* (from Bry. Eur. pl. 385). 1, 2, plants  $\times 1$ ; 1b, plant enlarged; 3-5, leaves; 5x-5x'', cross sections of leaf; 6a and 6b, leaf apex and base respectively, showing cells; 7, 8, capsules; 9, operculum; 10-13, peristomes; 14, lower portion of peristome; 15-17, structure of peristome teeth; 18, 19, perichaetal leaves; 20, synoicous inflorescence; 21, vaginule; 22, spores.

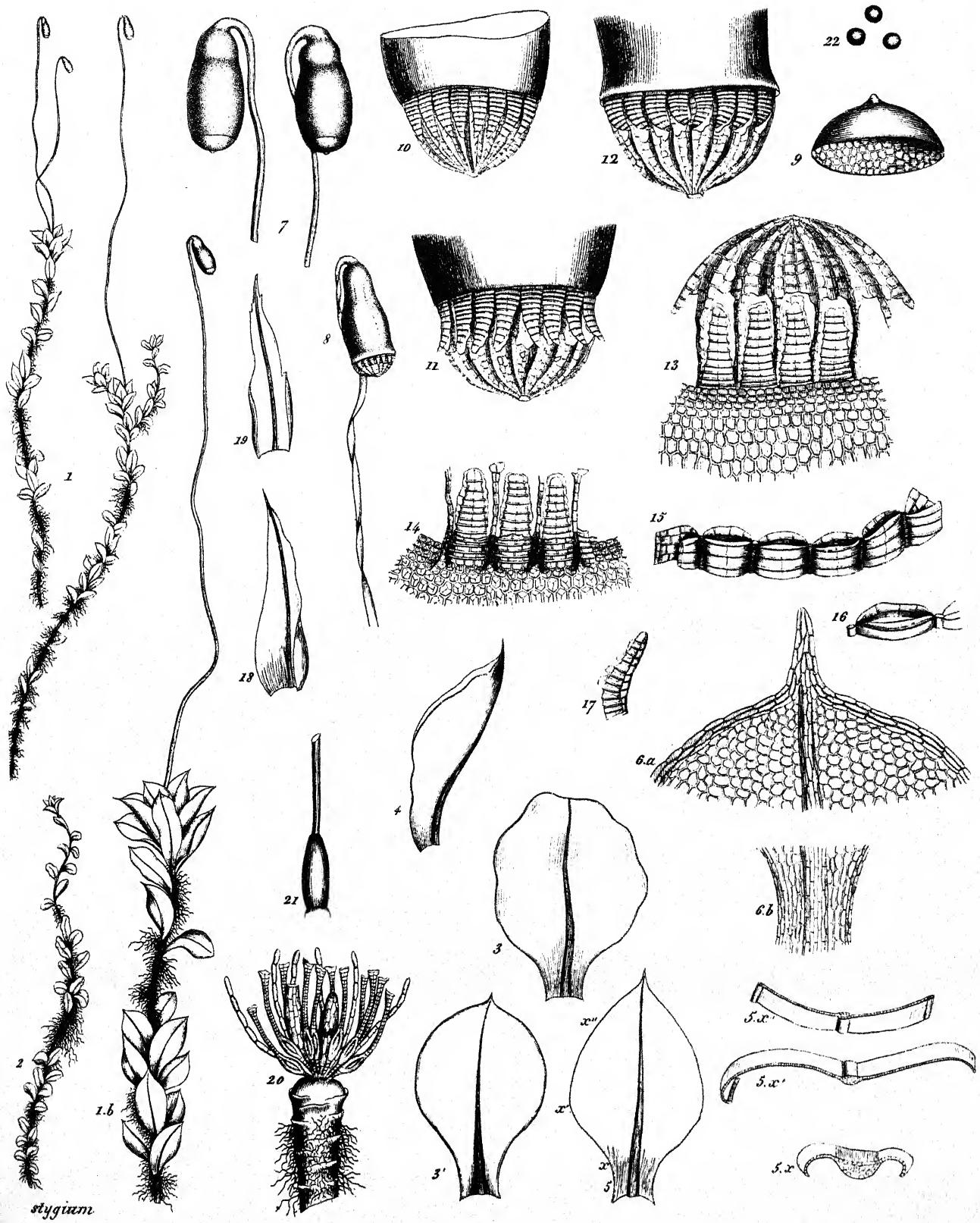


PLATE CVI

PLATE 107. 1, leaves of *Cinclidium latifolium*  $\times$  24 (from Möller, Arkiv. f. Botanik 21A; f. 43); 2, apex of the same  $\times$  50 (l. c. f. 44); 3, leaves of *C. subrotundum*  $\times$  12 (l. c. f. 45); 4, leaf apex of the same  $\times$  50 (l. c. f. 46).

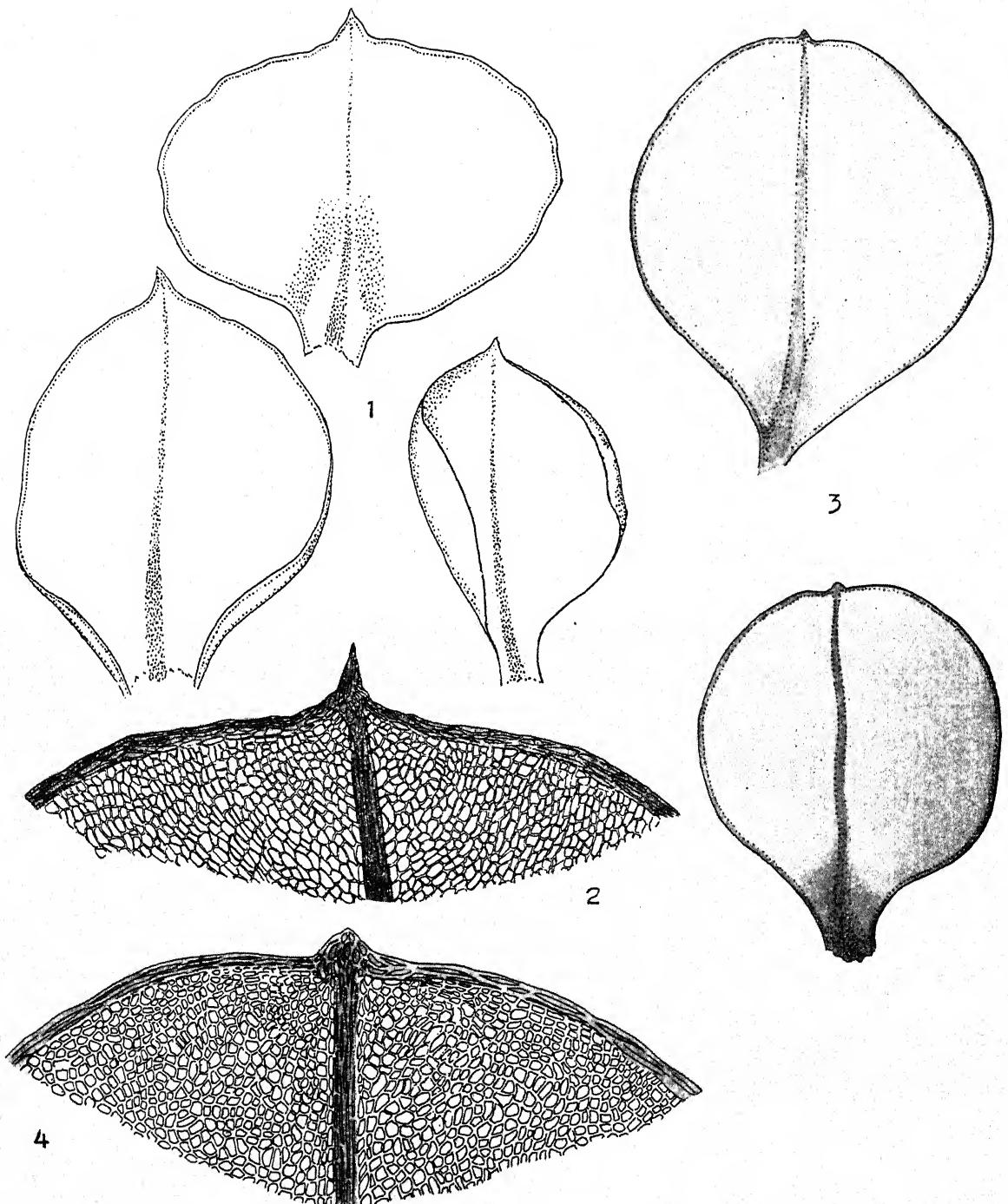


PLATE CVII

PLATE 108. 1-8, *Mnium hymenophylloides* (from Bry. Eur. *pl. 399*). 1, plants  $\times 1$ ; 2b, plant enlarged; 2, 3, 4, 6, leaves; 5, leaf apex; 7, perichaetial leaf; 8, archegonium and paraphyses; 13, leaf apex of the same  $\times 65$  from Möller, Arkiv f. Botanik 21A; f. 38; 9, leaves of *Mnium hymenophyllum*  $\times 24$  (from Möller, l. c. f. 49); 10, leaf apex of the same  $\times 65$  (l. c. f. 50); 11, leaves of *Cinclidium arcticum*  $\times 12$  (l. c. f. 47); 12, apex of leaf of *C. arcticum*  $\times 50$  (l. c. f. 48).

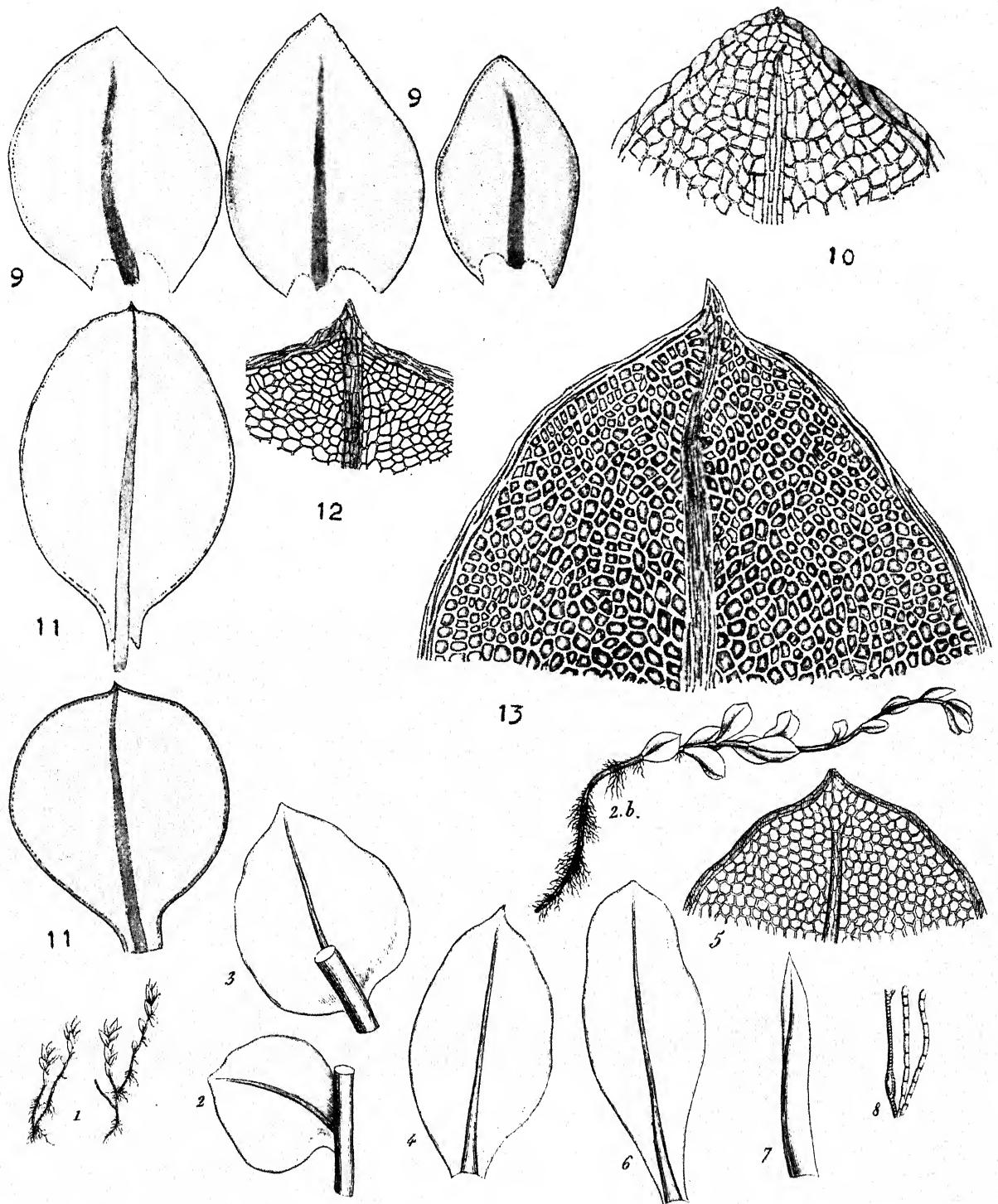
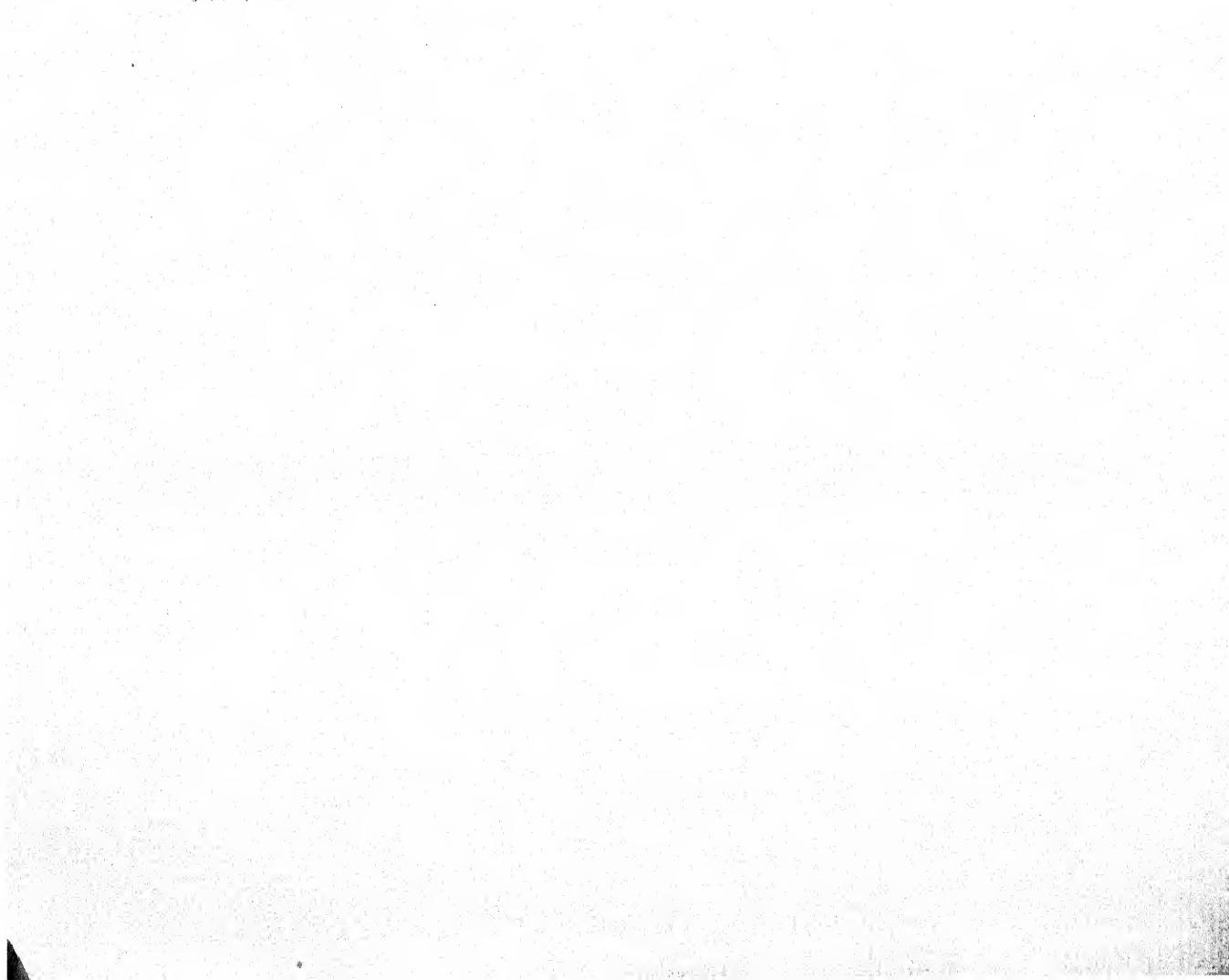


PLATE CVIII

PLATE 109. *Rhizogonium spiniforme* (from photographs by A. T. Beals). Massed plants as grown naturally  $\times 1$ ; insert about  $\times 2$ .



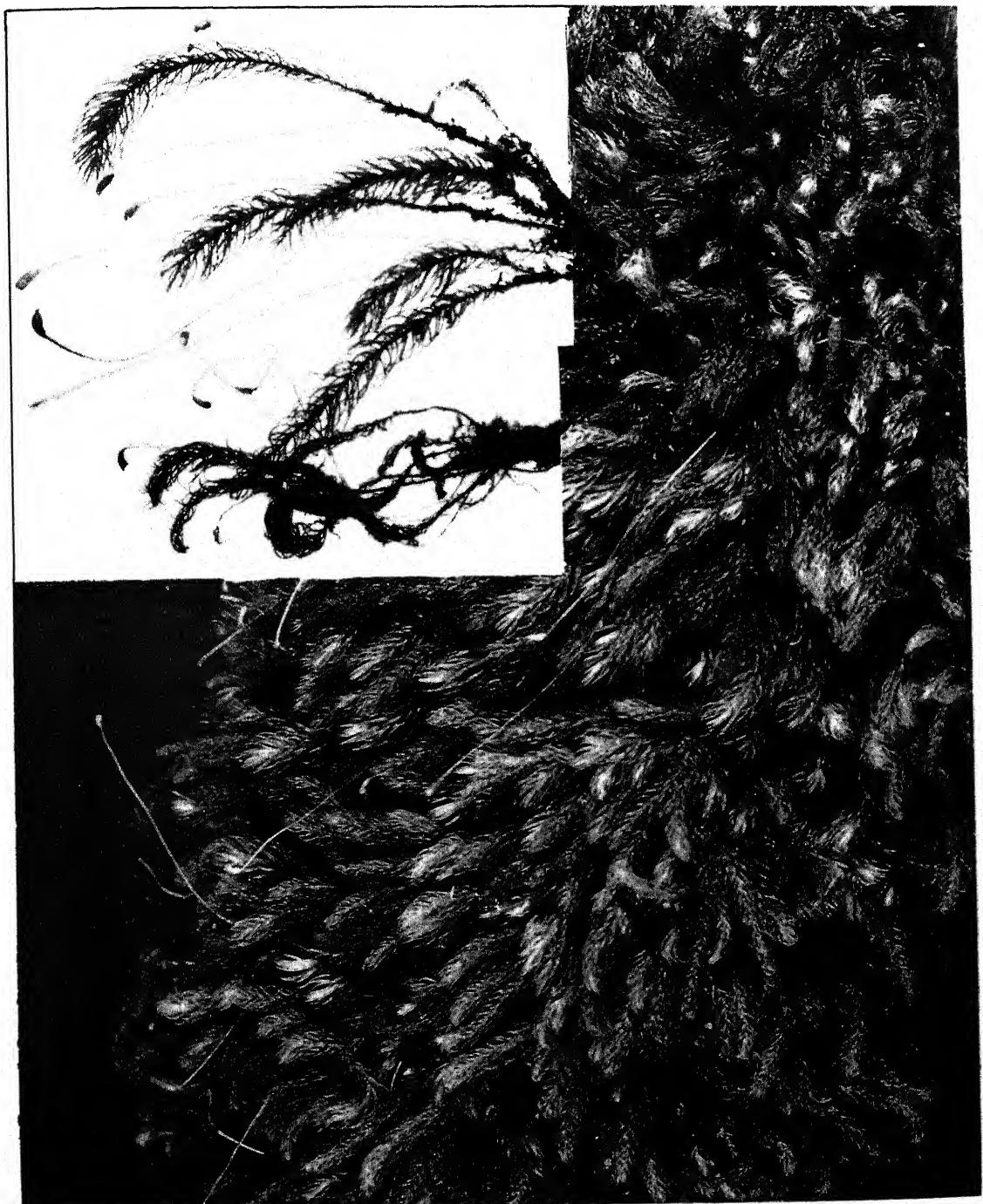


PLATE 110. *Rhacopilum tomentosum* (Figs. 1-21 from Bryol. 10: pl. 5; 22-24 from Engler & Prantl, Naturl. Pflanzenf. (Ed. 2) 11: f. 470). (Figs. 1-10 from co-type of Swartz from St. Domingo; 11-21 from Dr. Mohrs plants from Louisiana.) 1 and 11, branches showing arrangement of large and small leaves  $\times 6\frac{1}{3}$ ; 2, 3 and 12, 13, outlines of large leaves  $\times 12\frac{1}{3}$ ; 4, 5 and 14, 15, outlines of small leaves  $\times 12\frac{1}{3}$ ; 6 and 16, apex of large leaves showing excurrent costa  $\times 80$ ; 7, 17, median cells of large leaf  $\times 195$ ; 8, 19, surface view of large leaf showing papillae  $\times 333$ ; 18, profile view of curved leaf showing wavy surface caused by rounded cells and papillae  $\times 58$ ; 9, 20, cross section of large leaf  $\times 138$ ; 10, 21, cross section of stem  $\times 80$ ; 22, plant  $\times 1$ ; 23, capsule and calyptra  $\times 8$ ; 24, part of peristome  $\times 100$ .

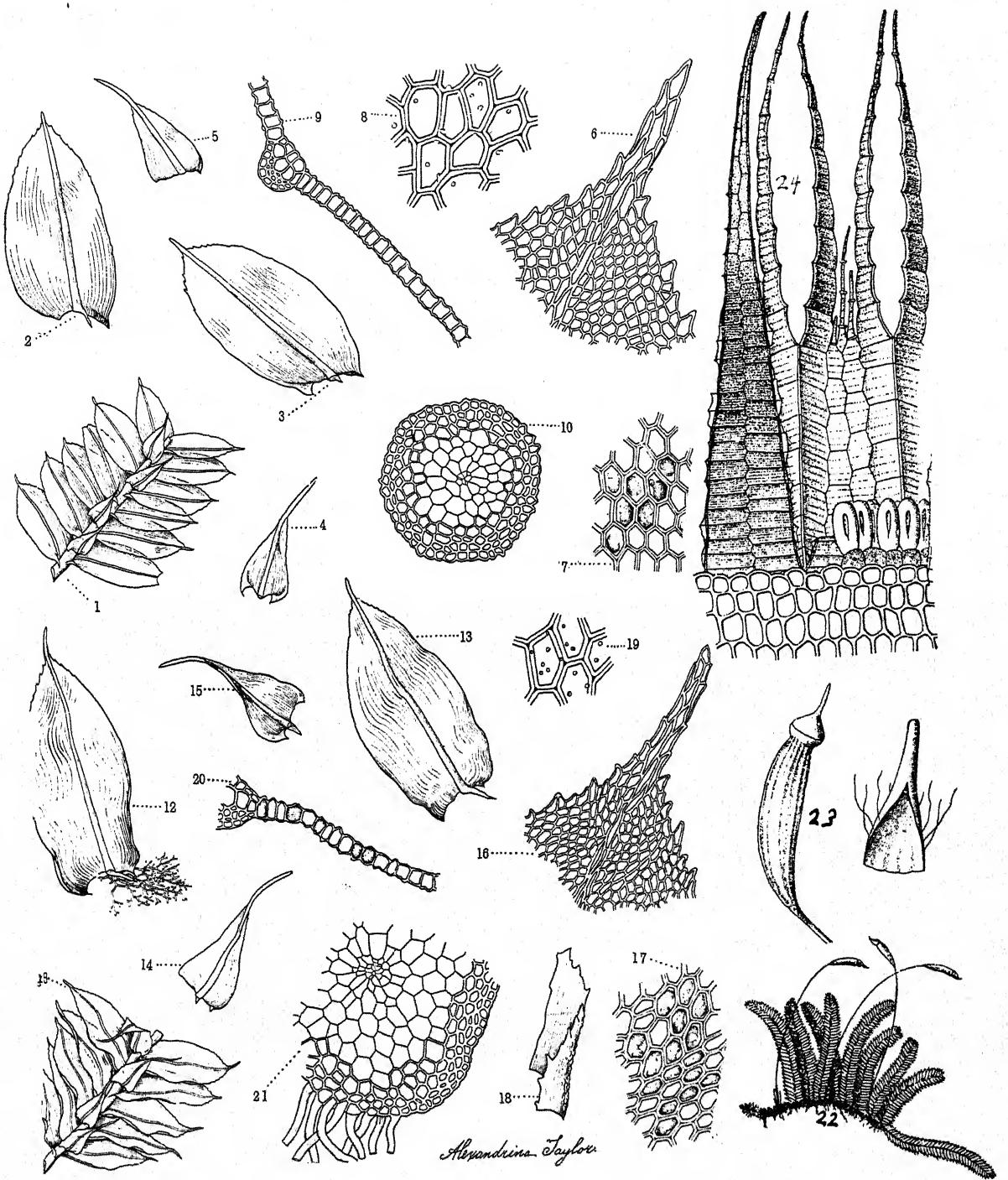


PLATE CX

PLATE III. *A. Entosthodon Wigginsii* (from Bryol. 41: 37. f. 1-8). 1, whole plant  $\times 10$ ; 2, single leaf  $\times 33$ ; 3, marginal cells of leaf margin, from just above the middle  $\times 135$ ; 4, marginal cells of leaf at basal angle,  $\times 135$ ; 5, cell detail from the end of the costa to the leaf apex,  $\times 135$ ; 6, a sector of the peristome showing five teeth and their markings  $\times 155$ ; 7-8, two tetrads of spores from different angles, to show attachment of the spores and their sculpturing  $\times 570$ .

*B. Splachnobryum Kieneri* (from Bryol. 38: pl. 5). 1, plant  $\times 1$ ; 2, 3, branch leaves  $\times 35$ ; 4, median leaf cells  $\times 140$ ; 5, basal cells  $\times 140$ ; 6, apex of leaf  $\times 140$ ; 7, cross section below middle of leaf  $\times 140$ ; 8, cross section of stem  $\times 190$ .

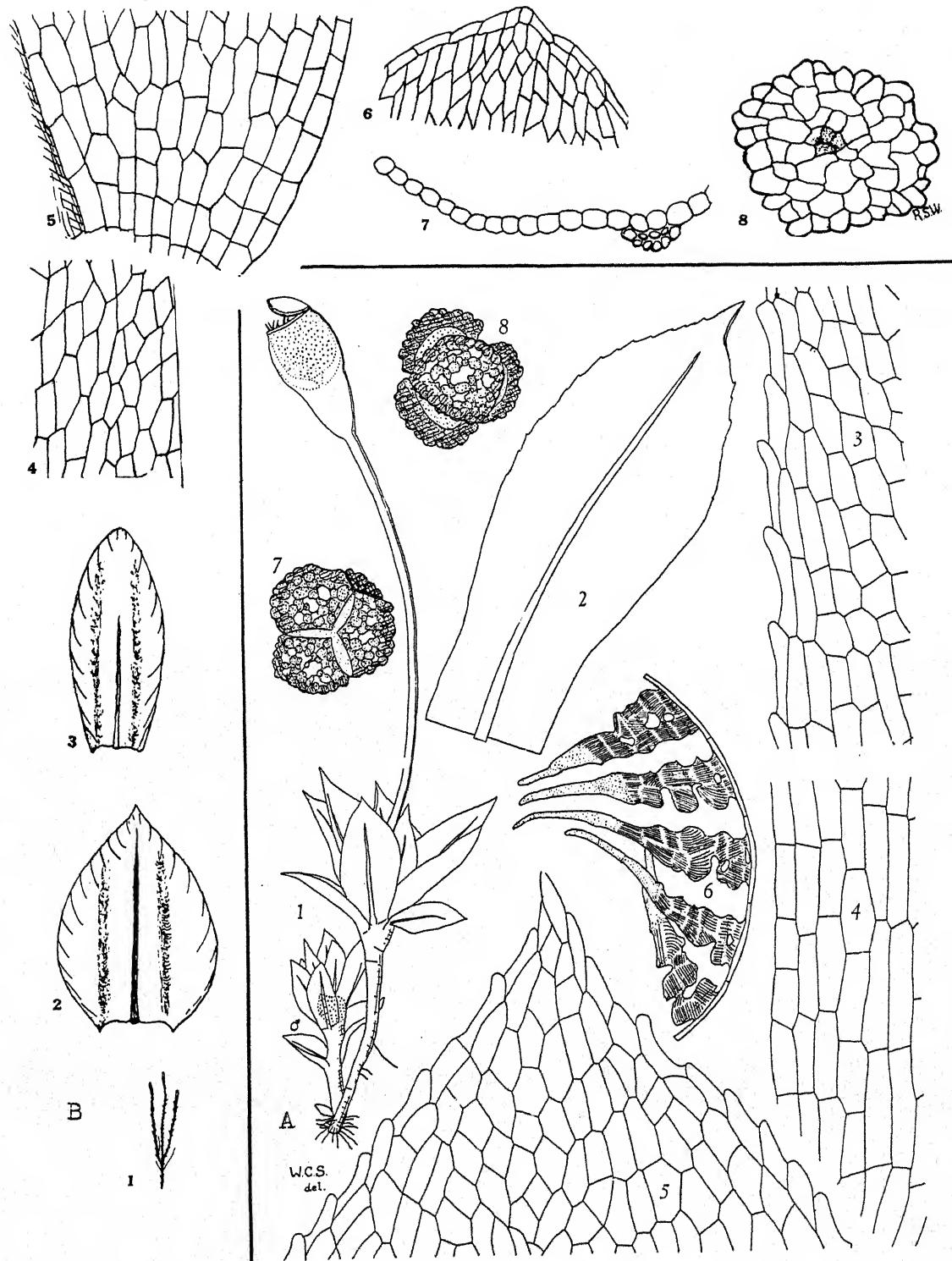


PLATE CXI

PLATE II2. 1-4, *Campylopus caroliniae*. 1, leaves  $\times 20$ ; 2, cross sections of leaves  $\times 400$ ; 3, median marginal cells  $\times 400$ ; 4, alar cells  $\times 400$ ; 5-7, *Crossidium desertorum*. 5, capsules  $\times 13$ ; 6, mouth of capsule, annulus and peristome  $\times 50$ ; 7, portion of peristome tooth  $\times 700$ ; 8-10, *Crossidium erosum*. 8, capsule  $\times 13$ ; 9, mouth of capsule and peristome  $\times 50$ ; 10, portion of peristome tooth  $\times 400$ ; 11-13, *Crossidium aberrans*. 11, capsule  $\times 13$ ; 12, mouth of capsule and peristome  $\times 50$ ; 13, portion of peristome tooth  $\times 400$ .

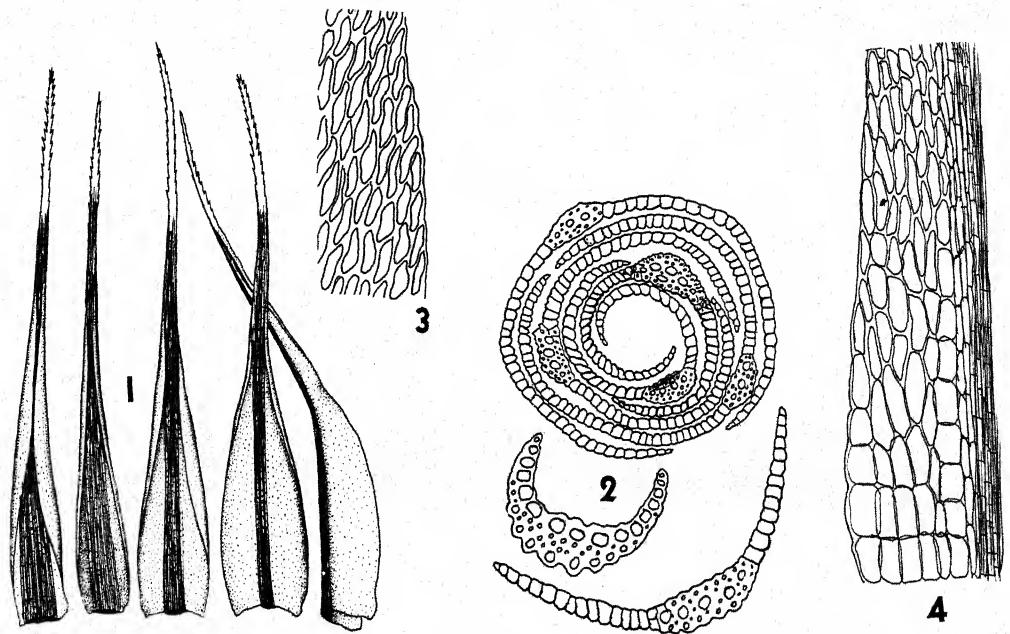
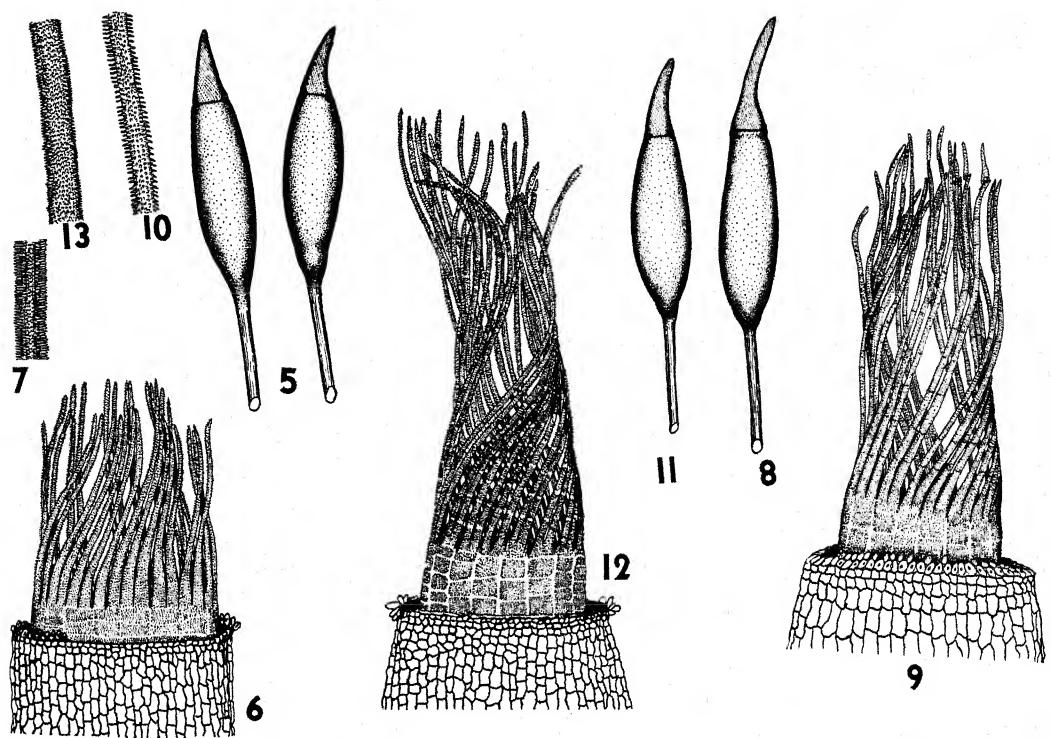
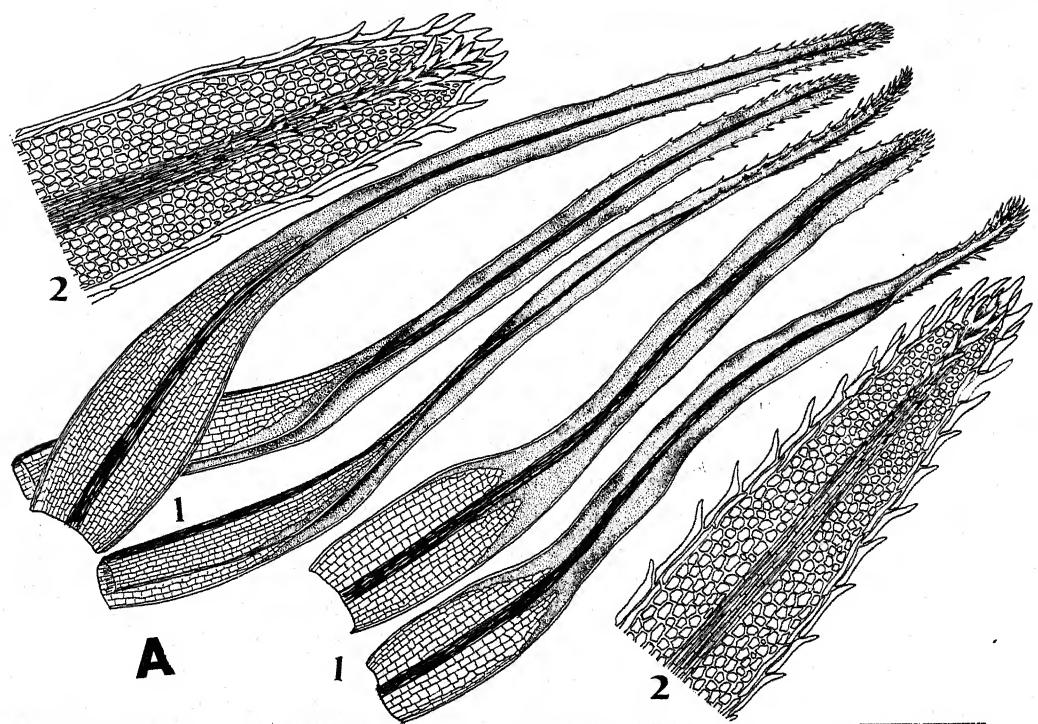


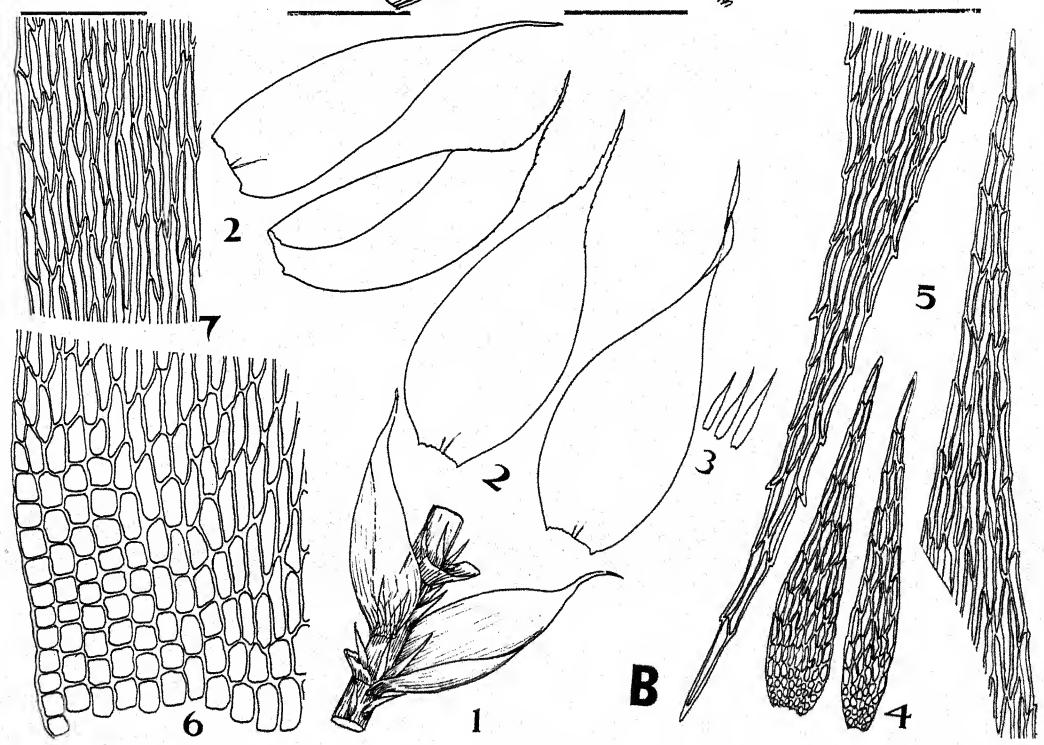
PLATE CXII

PLATE 113. *A. Syrrhopodon prolifer*. 1, leaves  $\times 20$ ; 2, leaf apices  $\times 200$ .

*B. Plagiothecium mariannae*. 1, portion of stem showing axillary paraphyllia  $\times 13$ ; 2, leaves  $\times 20$ ; 3, paraphyllia  $\times 15$ ; 4, paraphyllia  $\times 200$ ; 5, leaf apices  $\times 200$ ; 6, basal marginal cells  $\times 200$ ; 7, median marginal cells  $\times 200$ .



**A**



**B**

PLATE CXIII

PLATE II4. 1-6. *Lindbergia mexicana* (by E. B. Bartram). 1, moist plant  $\times 1.6$ ; 2, leaf  $\times 64$ ; 3, apex of leaf  $\times 400$ ; 4, basal portion of leaf  $\times 400$ ; 5, capsule  $\times 29$ ; 6, part of peristome  $\times 128$ .

12-20. *Desmatodon barbula* (drawings by Seville Flowers). 12, plant about  $\times 1$ ; 13, capsule and calyptora  $\times 16$ ; 14, part of peristome, annulus and upper cells of capsule  $\times 180$ ; 15, upper stem leaf  $\times 35$ ; 16, four perichaetal leaves and base of seta  $\times 11$ ; 17, cross section of leaf about half way down  $\times 180$ ; 18, upper part of leaf  $\times 180$ ; 19, basal cells of leaf  $\times 180$ ; 20, immature peristome from Florida material  $\times 200$ . (12-19 by R. S. Williams, 20 by Seville Flowers.)

More mature plants of the Florida material had peristomes like figure 14 but more papillose and shorter.

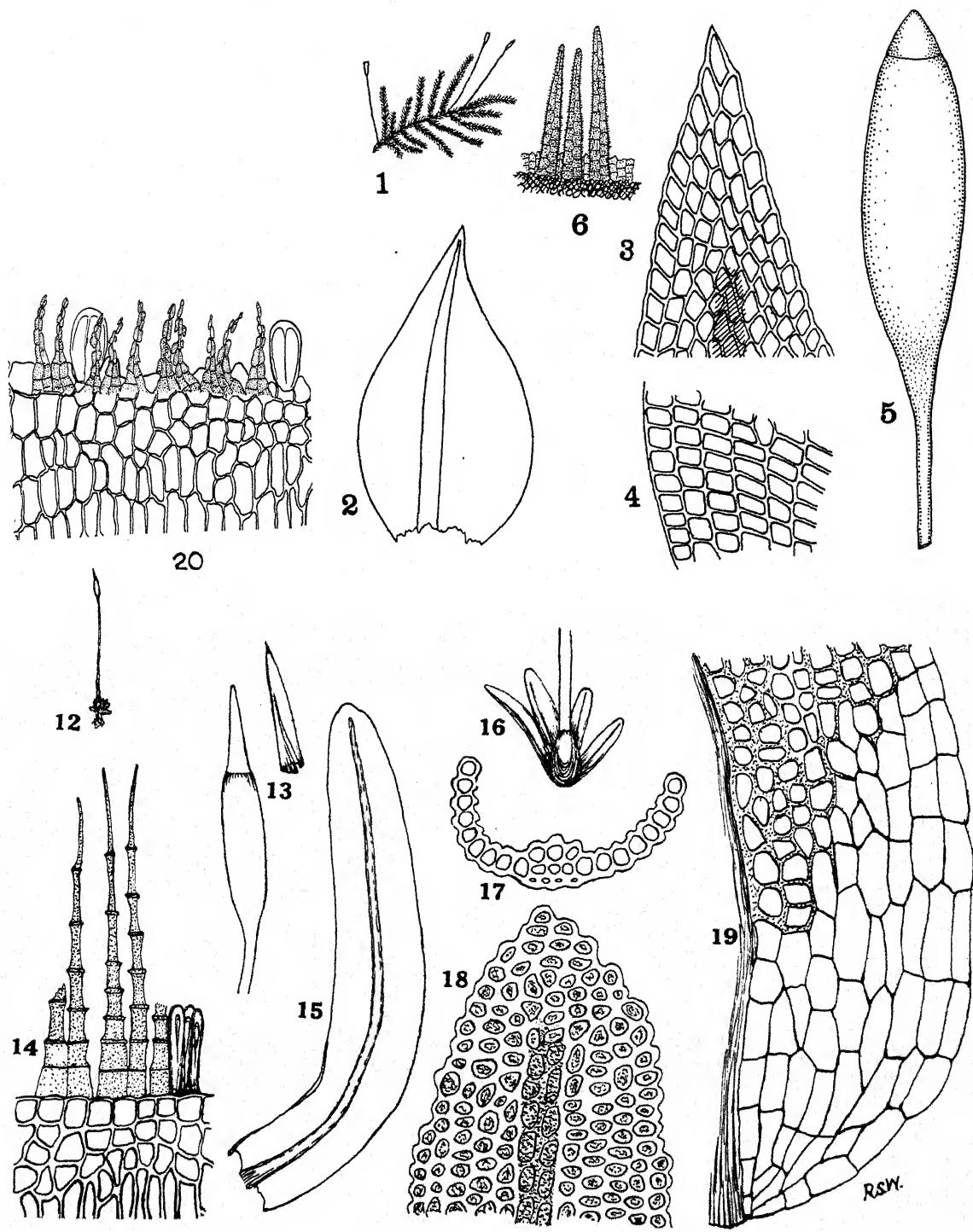


PLATE CXIV

PLATE 115. *Didymodon Hinckleyi* Bartram (from Bryol. 43: 97, f. 1-10). 1, 2, 3, plants  $\times 2$ ; 4, 5, 6, leaves  $\times 40$ ; 7, apex of leaf  $\times 500$ ; 8, part of cross section above mid-leaf  $\times 500$ ; 9, part of cross section below mid-leaf  $\times 500$ ; 10, capsule  $\times 36$  (at bottom of plate).

B. *Fissidens Andersoni*. 1, leaves arranged left to right, lower to upper; 2, cell structure at base and margin of leaf  $\times 200$ ; 3, cells of leaf apex  $\times 200$ .

D. *Ditrichum curritucki*. 1, stem leaves  $\times 20$ ; 2, perichaetial leaf  $\times 20$ ; 3, capsule  $\times 13$ ; 4, portion of peristome  $\times 100$ .

(B. and D. by Seville Flowers.)

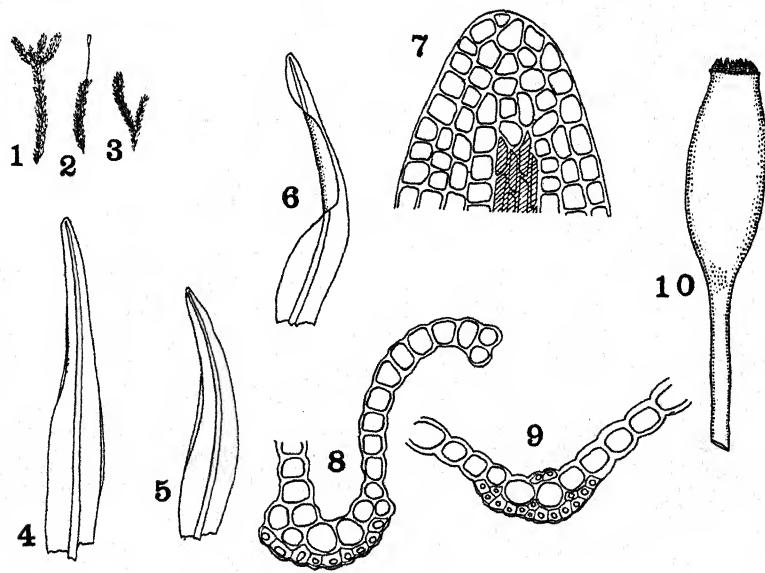
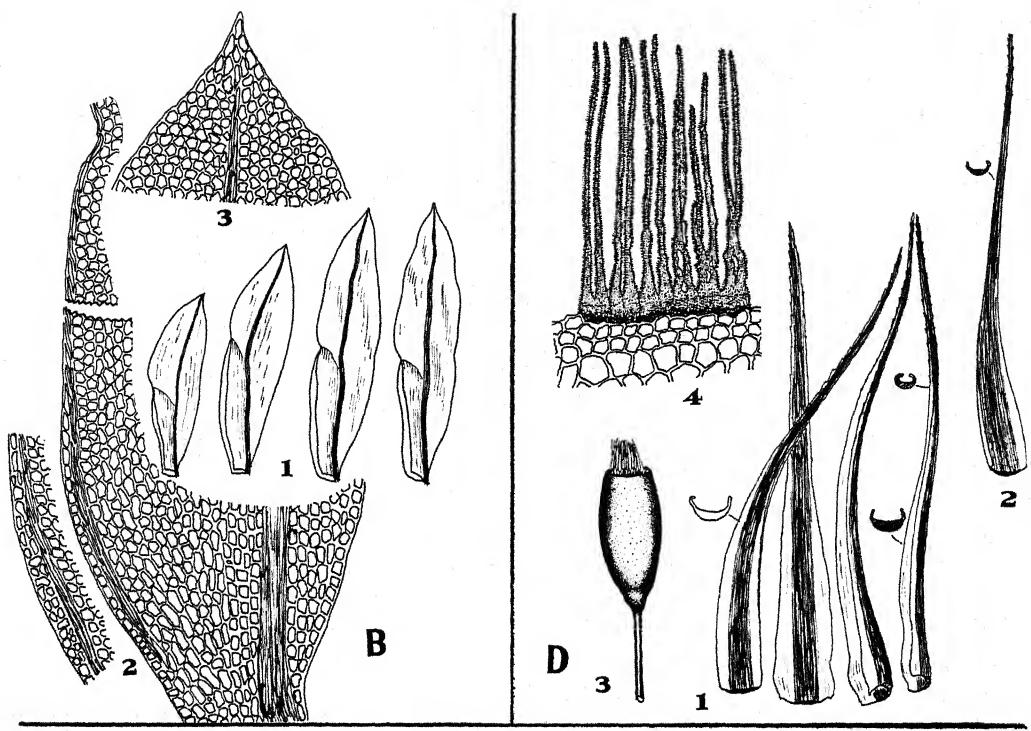
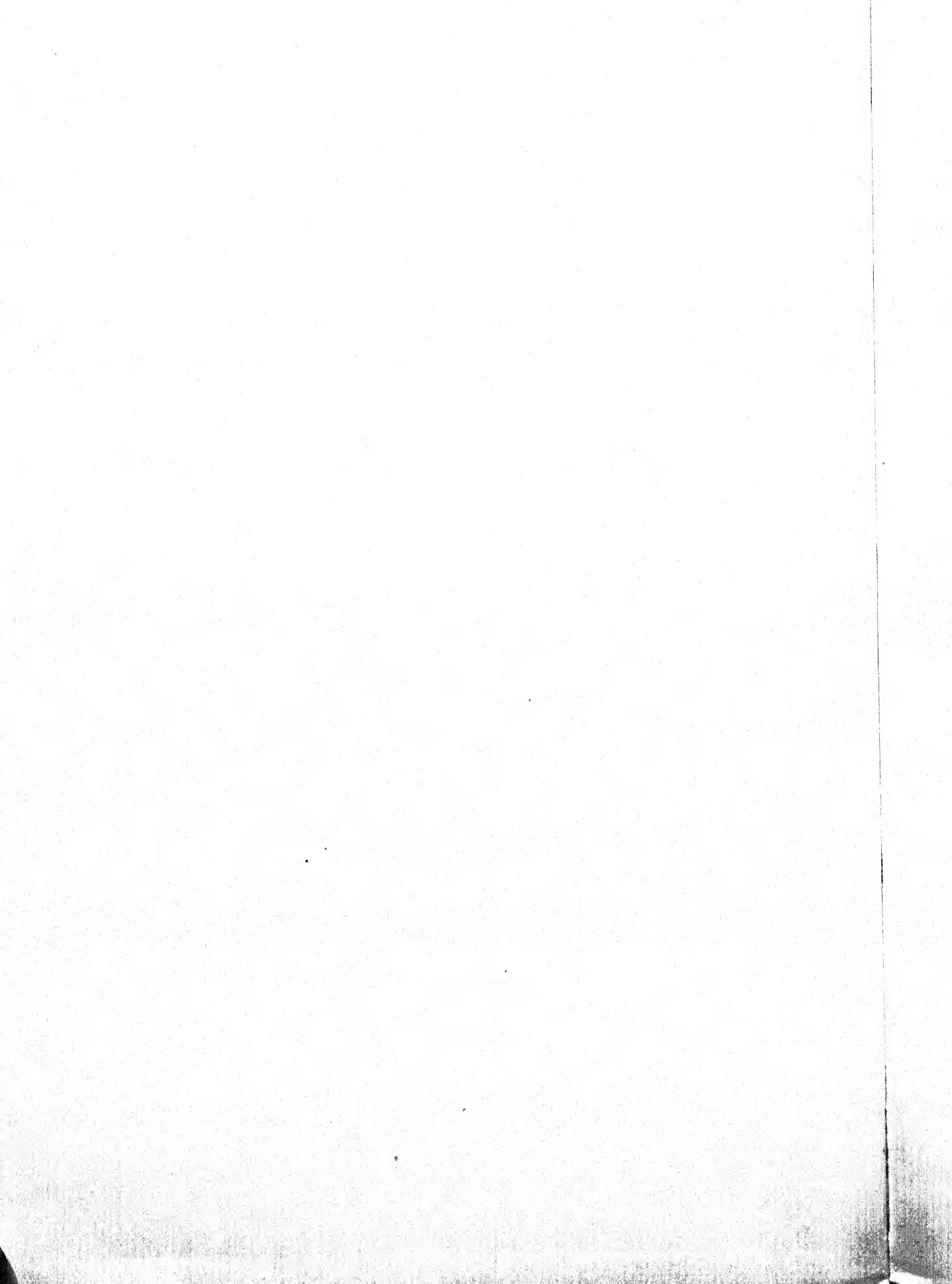


PLATE CXV



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